THE ATOM

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THE ATOM

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Issue Editor: William Regan
Photography: Bill Jack Rodgers
Contributors: Members of the PUB staff

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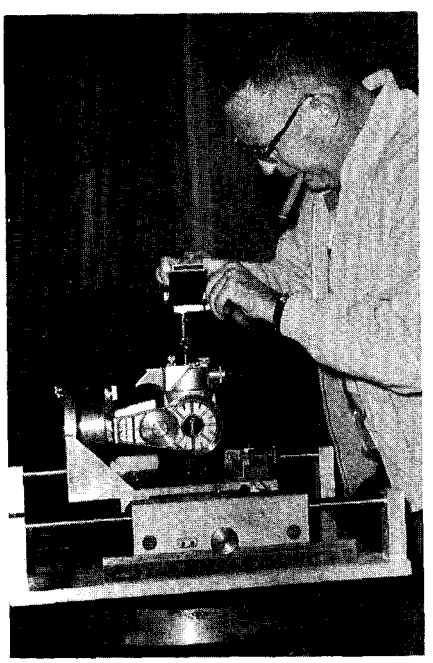
about the cover

Two Roberts—PerLee (shown in action) and Inglis, both of D-8—teamed up to take this long look at 980 feet of collimated hole at the Nevada Test Site. A 35 mm camera was attached to a Questar telescope with a 64 inch focal length. J-7 engineered the lighting, telescope and camera mount for this spectacular peek down an underground nuclear test shaft.



short subjects

Keith J. Carroll, CMF-9, will be one of 500 U.S. scientists and faculty members awarded lecturing assignments abroad next year under the auspices of the Fulbright-Hays international exchange program. Carroll, currently on a post-doctoral appointment at LASL, will lecture in experimental physics at University College, Cork, Ireland. He received his B.S. degree summa cum laude from Loyola University, New Orleans, Louisiana, and his M.A. and Ph.D. degrees from Rice University, Houston, Texas. He was a National Science Foundation Fellow at the latter institution. Carroll, his wife Jean (a native of Los Alamos), and infant son plan to leave Los Alamos at the end of August.

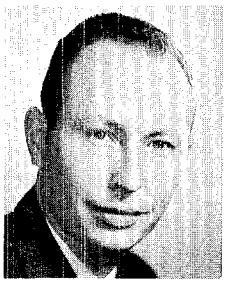
Thirty abstract illustrations—the product of Los Alamos school students from grades 1 to 12—are on public display in the first floor of the Personnel Building.

Bob Meier, Field Recruiting group leader, said the pictures were submitted initially for use in a series of six Laboratory advertisements in technical publications. The unusual quality of the group as a whole led to the present exhibit. A note of mystery has been injected into the display with the discovery that one painting is signed only "Anonymous, 2nd Grade." If anyone is able to identify the bashful artist, please notify PER-2.

A LASL employe, **Charles Lehman** of T-5, appears as a contributing author in the recently-published book by John Wiley and Sons, Inc., **Recent Advances in Optimization Techniques.**

Victor Trujillo, a SP-4 fork-lift operator, retired July 1. Trujillo, who has been with LASL since March, 1949, was previously employed by The Zia Company. With his wife and three sons, he lives in El Rito.

Lewis E. Agnew, Jr., N-5 physicist, is in Vienna, Austria, serving as Senior Officer in the Physics Section, Division of Research and Laboratories, International Atomic Energy Agency. During the two-year appointment, which started June 15, he will be on leave of absence from LASL. **Robert Keepin,** an N-2 staffer, held the same post from 1963-65. Agnew received his B.S. degree from the University of Missouri and his M.A. and Ph.D. degrees, all in physics, from the University of California at Berkeley. While at Berkeley, he was a National Science Foundation Fellow. Agnew, his wife Margaret, and four children left the U.S. in early June for the two-year overseas stay.



Gerald B. Rogers, SD-2 Design Engineer for 18 years (the past 10 "on loan" to CMB-6), retired June 30. A native of Toledo, Ohio, he is now living in La Mesilla, near Espanola, with his family.

Paul E. Martin, J-17 staff member at NRDS, retired June 30, after 3½ years with LASL. Prior to that, he was with the Martin Company in Denver, and also taught flight training at Muskingum College, New Concord, Ohio, where he numbered astronaut John Glenn among his students. His plans after retirement are indefinite, but he hopes to do "as much fishing and gardening as possible."

Harold M. Agnew, W Division Leader and Army Scientific Advisory Panel chairman, was the keynote speaker June 15 at the opening general session of the Army Science Conference at the United States Military Academy, West Point, N.Y. The theme of the conference, which attracted leading scientists from throughout the nation, was "Basic Research and Practical Relevancy."

more short subjects

Dr. Richard Houston Williams is the new director for the Los Alamos Graduate Center.

Dr. Williams, an assistant professor in electrical engineering at the University of New Mexico, replaces **Dr. Glenn Whan.** Dr. Whan was chairman of the nuclear engineering department at UNM before being named technical assistance expert for the AEC to the International Atomic Energy Agency in Lisbon, Portugal.

Dr. Whan left the UNM faculty and the graduate center directorship for his new post in early June.

H. R. Lewis and Emory Stovall, both of P-18, will attend the International School of Non-Linear Mathematics and Physics being held at the Max Planck Institute for Physics and Astrophysics in Munich, Germany, this summer. The School is sponsored by the Advanced Study Institute Program of NATO, and will run for six weeks, from June 27 through August 5. **LASL Research Advisor Stan Ulam** will serve on the faculty.

Del Sundberg Heads PUB

Delbert F. Sundberg, 39, has been appointed Department Head for Public Relations and assumed his new duties officially on July 1. He succeeds John V. Young who will retire the end of this month to become a free-lance writer and photographer.

A member of the Laboratory staff since 1951, Sundberg has served for the past seven years as Alternate Personnel Director. He holds a B.A. degree in economics from the University of Colorado and an M.S. degree in personnel management from the same university. Sundberg, a native of Colorado, served with the U.S. Army from 1944 to 1946, working as a Japanese interpreter. He attended Yale University and the University of Minnesota language schools as part of his military training.

Active in community affairs, Sundberg is now chairman of the Los Alamos County Personnel Board and was on the Board of Trustees of the Los Alamos Medical Center from 1958 to 1964. In 1963, he served as United Fund (then Community Chest) chairman. He is married and has one daughter, Ann, 7. His brother, David, was employed in the Public Relations Department from 1961 to 1964 and served as editor of The ATOM during his last year there.

Ross Lemons, first-place winner in the Los Alamos Science Fair and third place Physics Division winner at the State Science Fair, has been named by a team of Navy scientists to take one of the coveted week-long Navy Science cruises.

Lemons, a June graduate of Los Alamos High School, drew the attention of the Navy science team and was named alternate for the cruise with his exhibit titled "Plasmoid Interactions," a study on laboratory ways to simulate the interactions that cause galaxies to evolve and form in space. He is a son of Mrs. Lucille Lemons, 4653 Trinity Drive, and the late Joe F. Lemons, a long-time LASL staff member who headed CMF-2 for nearly 20 years.

The AEC Nevada Operations Office (NVOO) has established a new organizational unit with headquarters at Mercury, Building 111. Headed by Ray C. Emens, the group will be known as Nevada Test Site Support Office (NTSSO).

John Young To Retire

John V. Young, who on July 31 closes one career as an administrator with more than 20 years service to LASL, reopens another as a journalist, a profession which he followed for some 13 years prior to World War II.

Before coming to Los Alamos, in November 1945, as wage and salary administrator, Young was director of personnel and public relations for Eitel-McCullough, Inc., San Bruno, California, radar tube manufacturer. He became LASL Personnel Department head August 1, 1946, and served in that capacity until he organized the Public Relations Department in March, 1959.

Young served two terms, one of them as president, on the first elected school board in Los Alamos. He has been a Mesa Library Board member, two-term Mesa School PTA president, Town Planning Board member and Housing Policy Board advisor.

Young plans to remain in Los Alamos, where he and Mrs. Young have purchased their Western Area home, and intends to do some work as a public relations consultant in addition to free-lance writing for magazines and newspapers. Mrs. Young (Emma Lou) is a data analyst in T-3. The Youngs are the parents of two daughters, Mrs. Howard F. Smith of Los Alamos and Mrs. James A. Brown of Berkeley, California.

ANS MEETING

Bell Named Fellow

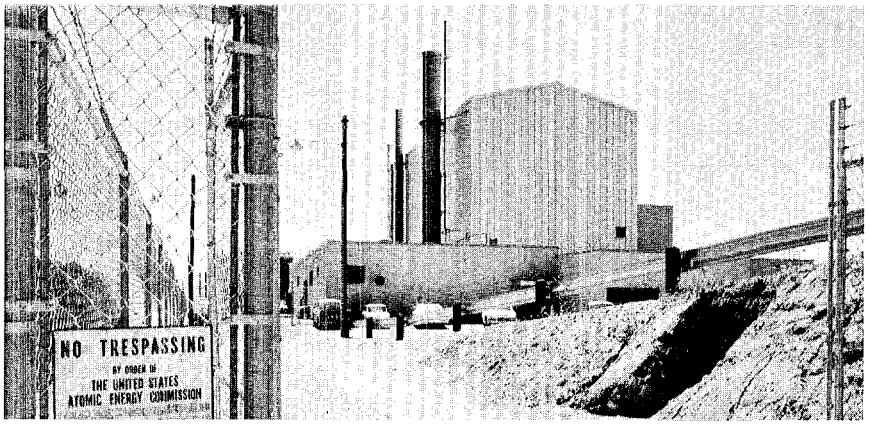
LASL people played an important role in the 12th Annual Meeting of the American Nuclear Society held last month (June 19-23) in Denver.

Director Norris E. Bradbury was guest speaker at a general luncheon session June 20; Technical Associate Director Raemer E. Schreiber took office as Vice President of the Society; Hugh C. Paxton, N-2 Group Leader, was elected to the Board of Directors; and George I. Bell, T-DOT, was elevated to the position of Fellow of the ANS and received a certificate of merit for broad and deep contributions to reactor theory.

Bradbury, in his address before one of the opening sessions of the Society, stated that although in the beginning days of the Manhattan Project Los Alamos Scientific Laboratory was driven by a "singleness of purpose," that purpose has now given way to diversity, and it is his belief that in the future the national laboratories, including LASL will be involved increasingly in more fundamental research.

Schreiber and Paxton are both Fellows of the ANS and the American Physical Society. Schreiber has been a member of the Board of Directors of ANS since 1962. Paxton is a charter member of the ANS.

Bell's Fellow citation reads, "For his important contributions to neutron transport theory, reactor kinetics, multi-group neutronic theory, and methods of computation in complex reactor geometrics." A LASL staffer since 1951, he is also a member of the American Physical Society and of the American Association for the Advancement of Science. He received his Ph.D. in theoretical physics from Cornell University and his A.B. in physics from Harvard University.



Work has stopped on this nearly-completed Fast Reactor Core Test Facility. The building and some equipment may be utilized for testing actual sections of the proposed LASL proton accelerator (LAMPF) at full power.

AEC Cuts Reactor Budget

The AEC has cut $2 million from the requested fiscal year 1967 budget for reactor fuel development at Los Alamos and has ordered the new Fast Reactor Core Test Facility (FRCTF) at Ten Site shut down, according to Laboratory Director N. E. Bradbury. This action could affect 40 to 50 employes over the next year, Bradbury said.

The principal effort in this field at Los Alamos has been an investigation of the use of molten plutonium for fast breeder reactors divided between K Division under David Hall and CMB Division under Richard D. Baker.

The FRCTF, nearly completed, has cost $5.3 million out of a total of $8 million including equipment which was authorized by the AEC. The building alone has cost $3.2 million to date.

Aware of the impending change for several months, the laboratory management has made vigorous efforts to have the program continued. Discussions are continuing with the AEC on possible new programs in which some of the people concerned might be employed. Opportunities to transfer people to existing programs elsewhere in the laboratory are also being actively explored.

According to a letter received this week by Bradbury from the AEC, the program reduction is the result of a decision to use available funds for the development of fast reactor fuels which the AEC has selected as being suitable for immediate application, such as uranium-plutonium ceramic fuels and solid alloys. The letter said that the molten plutonium fuel program, while still a possibility for the future, "cannot be considered for competition for funds with other programs at this time."

"In the meantime" the letter concluded, "we look forward to contributions from the laboratory in the many areas of advanced technological development it will undertake in the re-oriented program."

Studies are also being made of possible alternative uses for FRCTF. The AEC has ordered work stopped on the new facility but has encouraged the laboratory to seek other uses for the installation. Among the suggestions now being explored is the possibility of using the building and some of its equipment to make full power tests of actual sections of the half-mile long accelerator being designed for the proposed LASL Meson Physics Facility. The FRCTF building has sufficient shielding and other features usable for meson work.

fission-couple

Speck In Reactor Says Scram

By ED WALTERSCHEID

All nuclear reactors must have some form of "scram" mechanism that ensures sudden shutdown in an emergency or as a result of a rapid deviation from normal operation. Obviously, in the interest of safety, any device used to initiate a scram must be both extremely fast and very reliable.

These criteria are met by a unique new instrument, known as a fission-couple, which directly monitors neutron density within a reactor. The instrument is the brainchild of J-8 staff member Rod Morrison who has been assisted in its development by another J-8 staffer, Dan Stillman.

The fission-couple derives its name from the fact that it operates in the same fashion as a thermocouple, but makes use of a tiny bit of the reactor fuel as the actual sensing element. This sensing element is smaller than the head of a pin, and the alumel and chromel leads attached to it are only five ten-thousandths of an inch in diameter. Chromel and alumel are alloys commonly used to make up a thermocouple.

In a conventional thermocouple, a loop is formed by joining two different metals. Heating of one of the junctions causes an electric current to flow in the loop. The amount of current is proportional to the temperature differential between the two junctions and hence is a direct measure of temperature at the hot end.

Conventional thermocouples, at best, indicate only the temperature of the hot junction. Unfortunately, this is not necessarily the same temperature as that of the surrounding region, particularly if this region is changing temperature rapidly. Because heat must flow into the junction (see sketch, page 7), there is always a time delay in the recording of temperatures away from the thermocouple itself.

A fission-couple also tells only the temperature of the hot junction, but in this case the temperature is the same as that of the fuel elements since the sensing element is composed of the same material as the fuel. Heat is actually flowing away from rather than into the sensing element. There are two hot junctions (chromel-uranium, alumel-uranium), one on either side of the sensing element, but since they are at the same temperature they effectively act as a single hot reference junction.

In a reactor, the temperatures of primary interest are those of the fuel elements. Conventional thermocouples simply cannot monitor abrupt changes in fuel element temperatures in sufficiently short times to initiate a scram, should one become necessary.

In reactors, neutron-induced fission releases fission fragments whose kinetic energy is dissipated in the surrounding fuel in the form of heat. Any increase in the number of impinging neutrons causes more fissions to occur with the release of more fission fragments and more heat. Since neutrons act on the fission-couple in the same fashion as they do on nearby fuel elements, temperatures measured by the fission-couple are essentially the same as those in the nearby fuel and thus a direct measure of the neutron density.

For this statement to hold in all cases, there are certain restrictions that must be placed on the size of the sensing element. If the element is too large, the danger of nonuniform heating from self shielding exists. For uranium 235, the maximum size is slightly larger than 16 thousandths of an inch. The minimum size is dictated by the average distance fission fragments can travel and still be stopped within the material of the sensing element. In uranium, the fission fragment range is about three ten-thousandths of an

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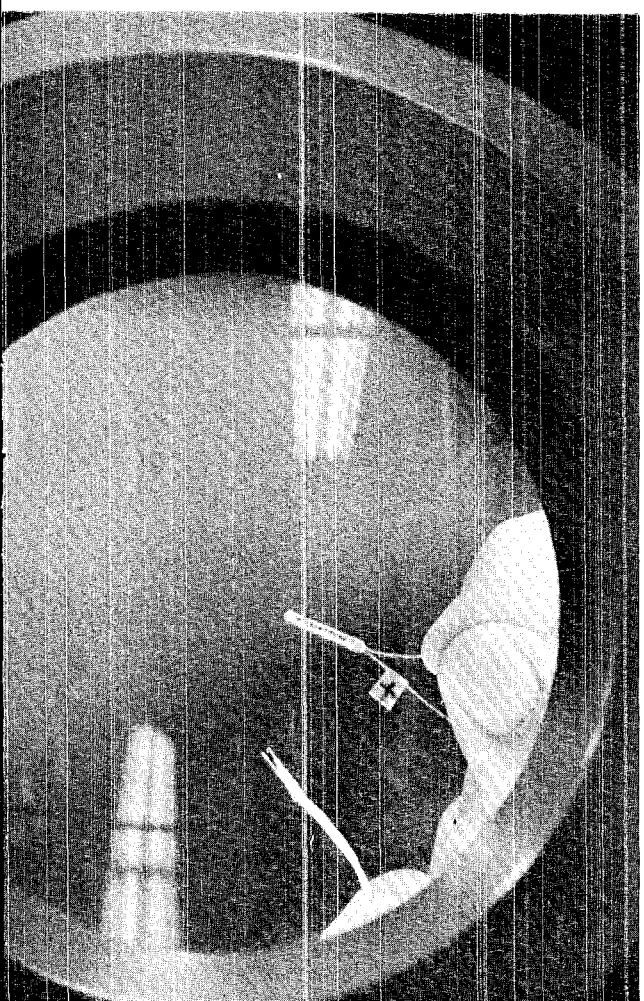
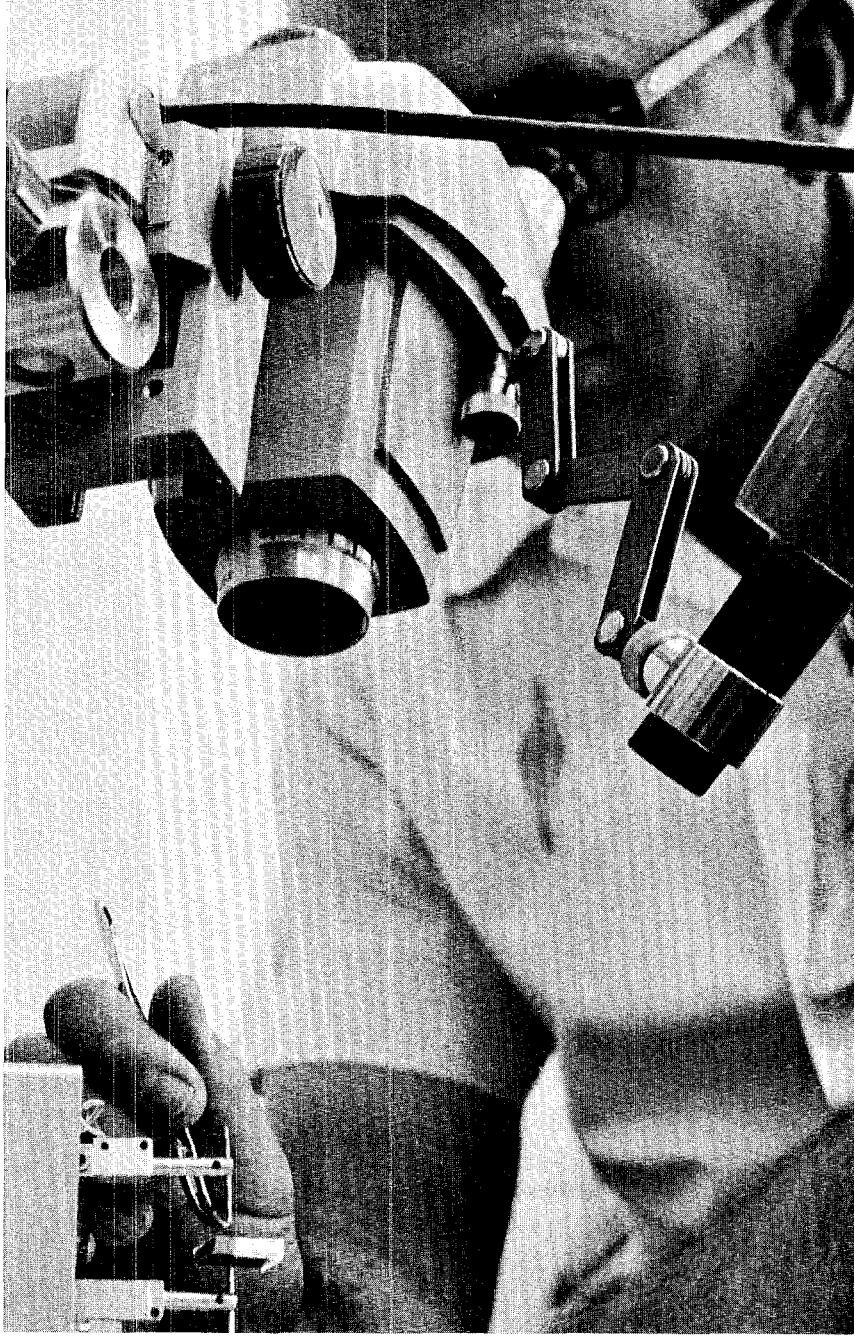
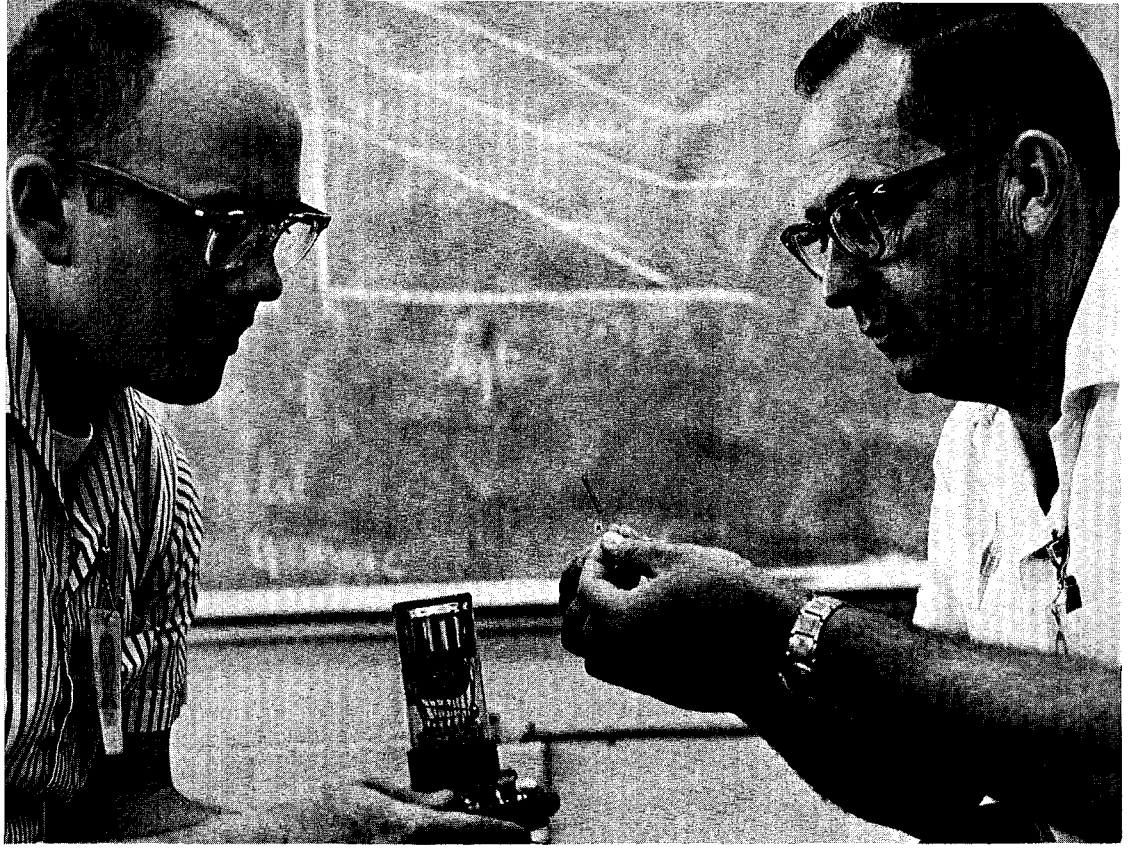
Fission thermopile (top) and fission-couple.





Rod Morrison in the act of preparing a fission-couple with a microwelder.



Stillman (left) and Morrison compare photomultiplier, used in present reactor instrumentation, with fission thermopile.

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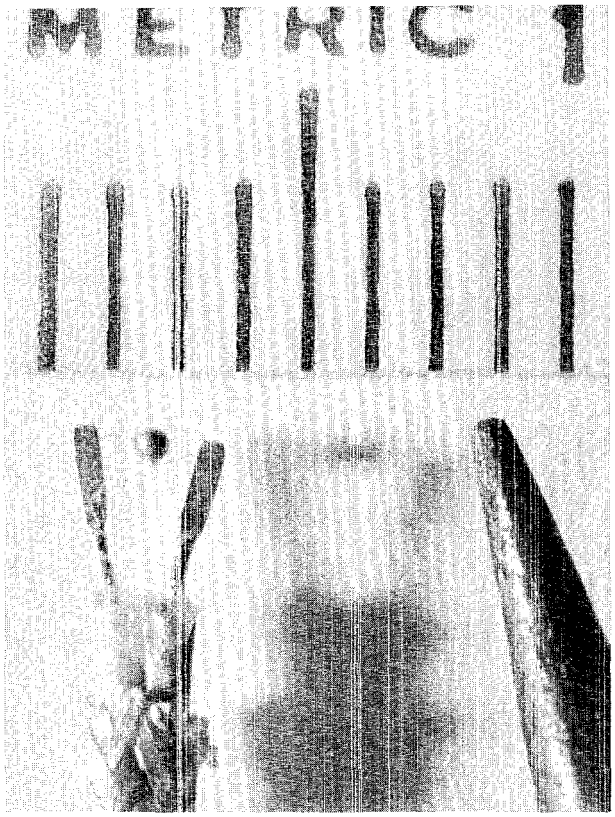
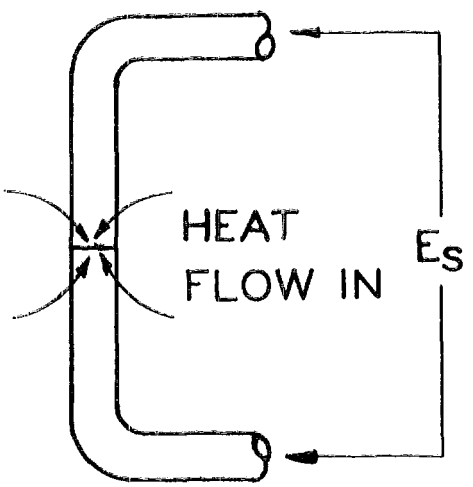
inch. The minimum diameter of fission-couples thus far successfully tested has been four thousandths of an inch.

Present scram initiating systems most often make use of scintillator or ion chamber sensing devices. Scintillators respond to the gamma radiation produced by nuclear fissions. The gamma rays cause scintillations, or flashes of light, in certain plastics, and these can be rapidly detected by photocells. Unfortunately, the neutron flux within a reactor activates the surrounding components which also give off gamma rays. Scintillator devices are rather large and must be placed some distance away from the reactor fuel elements. They view a wide area as a result and hence cannot be used to give diagnostic information about specific points within the critical mass.

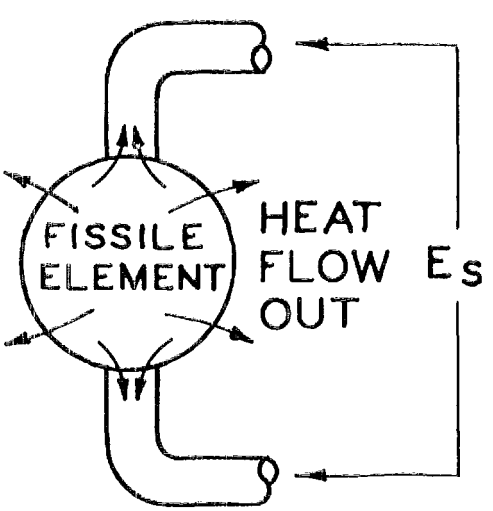
Ion chambers can be made very compact—although not nearly so compact as a fission-couple—but they have a limited life in the severe radiation field in or near a reactor. One form of an ion chamber known as a fission chamber consists essentially of a gas-filled chamber internally coated with a uranium compound enriched in uranium 235. An electrical potential is established across the hollow center of the cylinder. Neutrons striking the walls of the cylinder cause fissions to occur and the resultant fission fragments produce considerable ionization in the gas which in turn produces changes in the electrical current that are easily detected.



Small size of fission-couple is demonstrated by comparison with sharp pencil point.



In a conventional thermocouple junction (above) heat flows into the junction, whereas with a fission-couple junction (below) heat flows away from the junction.



Although ion chamber detectors can be made quite small, they still contain sufficient material to cause a perturbation in the neutron flux within the reactor. They thus cause a change in the very thing they are attempting to measure. Fission-couples, however, contain less than one milligram of fissionable material and have very little effect on the flux.

Thus far in this article, fission-couples have been discussed primarily as possible scram initiators. They also have excellent potential applications for routine control and diagnostic work.

In their book, *Nuclear Reactor Engineering,* Glasstone and Sesonske state: "The ideal instrument for reactor control should be capable of detecting neutrons in the presence of strong gamma radiation; in addition, it should be accurate and respond rapidly to changes in neutron flux."

This is almost a perfect description of the capability of fission-couples. They are fast, giving accurate measurements of reactor periods in less than 15 millionths of a second. (The period of a reactor is the time required for the neutron density or reactor power to change by a factor of 2.71.)

Through a simple but ingenious arrangement, they are capable of filtering out all "noise" caused by gamma radiation. Gamma rays striking the sensing element of a fission-couple heat it and thus add an increment to the temperature recorded by the couple.

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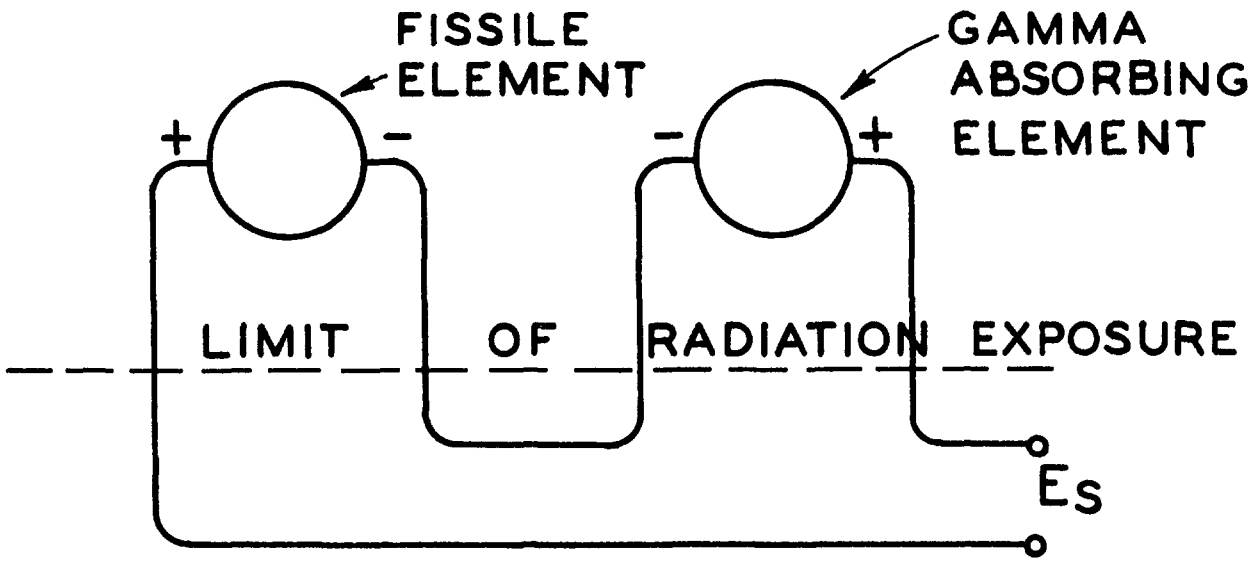

Fission-couple differentiates between neutron and gamma heating in the manner show above. Fissile element and gamma absorbing element heat the same amount due to gamma rays but potentials are reversed so that current from gamma absorbing element cancels gamma current from fissile element.

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To counter this increment, another sensing element made of nonfissionable material with the same density and heat capacity but with the leads reversed is placed in the fission-couple circuit. Gammas heat both elements by the same amount, but the current produced by the inert element junction "bucks" that from the fissionable element junction and thus cancels it. The resulting signal is then due only to neutron heating in the fissile junction.

Accurate control of a reactor requires the ability to detect small changes in neutron flux. Although small flux changes generate only small temperature variations, these variations can be monitored by placing a number of fission-couples in series in the same circuit. The signal from each couple is added to the next until an easily measurable current is produced. A series of gamma-compensated fission-couples is known as a fission thermopile.

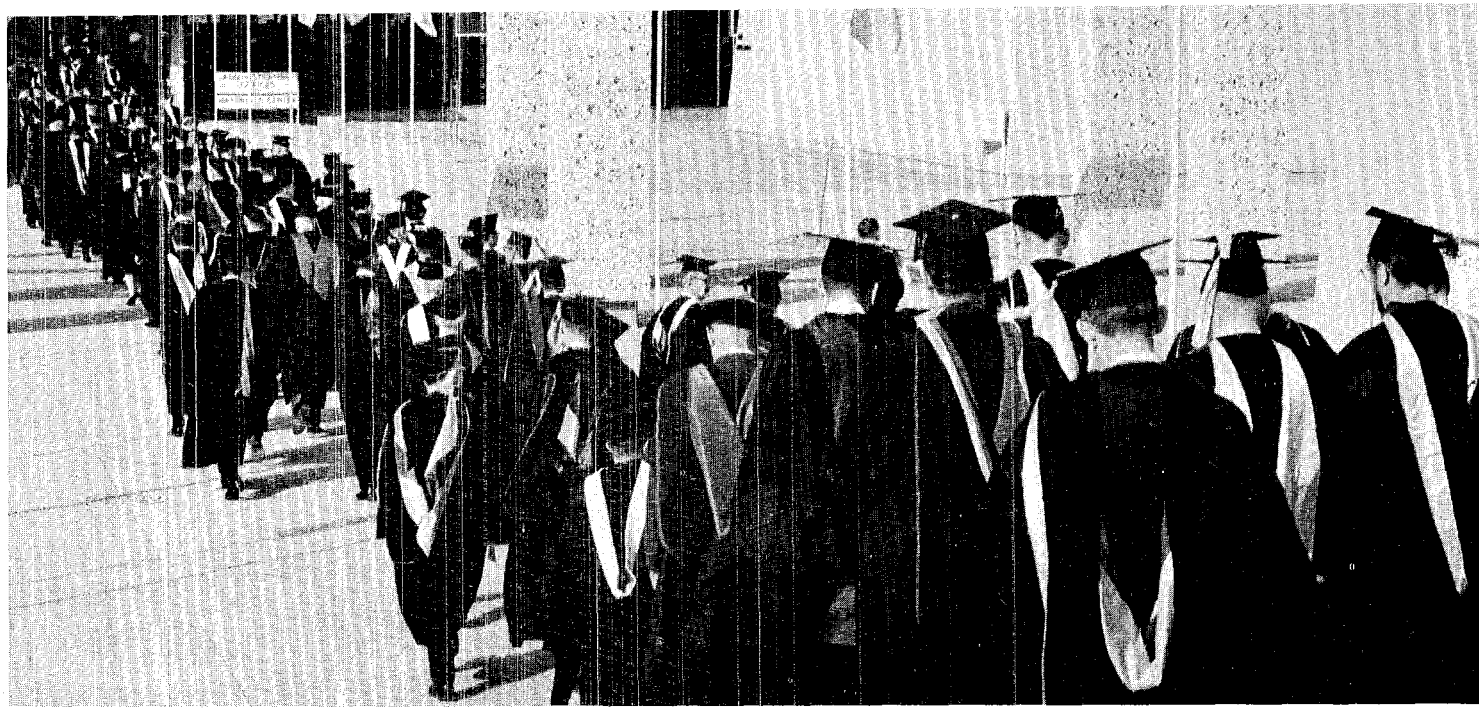
Most of the fission-couple work at LASL has been under the sponsorship of the Rover Flight Safety Office. As a consequence, NASA, which funds part of the Rover program, has expressed an interest in the fission-couple for their technical utilization program. A more popular word for this is spinoff. They think it may have possible commercial applications.

Fission-couples have yet to be exposed to long-term severe radiation environments within reactors. But there is no reason to suspect that reactor environment lifetimes of the sensing elements will not be much longer than those of presently used sensors. The basic thermocouple materials, e.g., chromel, alumel, and the reactor fuel, have long radiation survival characteristics.

In the field of neutron diagnostics, fission-couples appear to have numerous applications. One that is being actively explored is dynamic dosimetry. Sandia Corporation is working to establish a curve of fissions per gram versus change in temperature or, what is the same thing, integrated neutrons per square centimeter versus change in temperature for various fission-couples. The establishment of such calibration curves would mean that fission-couples could be used as flux mapping devices in and around reactors.

Another possible application is in the measurement of neutron energies. By making the fissionable junction of various materials such as uranium 235, uranium 238, plutonium 239, etc., which are all fissioned by neutrons of different energies, it should be possible to determine with considerable accuracy the neutron spectrum produced within a particular reactor.

These are but a few of the measurements that appear possible with fission-couples. Much work remains to be done with them, and not all of the applications mentioned here may prove to be feasible. But the miniature size, minimum flux perturbation, and radiation resistance of fission-couples combine to make them a most promising new tool in reactor diagnostics and control.



academic training

Advanced Degrees Awarded 19

Advanced degrees from the University of New Mexico were awarded to 19 LASL employes last month under the Lab's Academic Training Program.

This brings to 127 the number of Laboratory employes who have received degrees under the program in the past dozen years, according to Ted Dunn of Personnel's Orientation, Testing and Training Group. The total includes 14 bachelors degrees, 87 masters and 26 Ph.D.'s.

The 1966 "class" received 14 masters and 5 doctorates.

Receiving Ph.D.'s were Edward Flynn, P-10, physics; Raymond Gore, N-4, electrical engineering; Rodney Thurston, CMF-9, mechanical engineering; John Vigil, K-1, nuclear engineering; and John Ward, CMF-5, chemistry.

Master's degrees were awarded to Robert Derusseau, K-2, nuclear engineering; Kenneth Duerre, K-4, mechanical engineering; James Harper, GMX-6, nuclear engineering; Valgene Hart, MP-3, mechanical engineering; Robert Lutz, GMX-7, physics; Philip Mace, J-8, electrical engineering; Thomas Merson, N-3, mechanical engineering.

William Roach, N-2, nuclear engineering; William Sanders, K-1, nuclear engineering; Barry Shafer, W-1, mechanical engineering; Daniel Stoller, K-2, engineering science of materials; Ellery Storm, H-1, physics; Don Welch, K-1, nuclear engineering; and Robert Wenzel, P-2, physics.

The Academic Training Program under the sponsorship of LASL started in 1948, Dunn said, when a number of extension courses were offered at Los Alamos by the University of California. In the fall of 1950, UNM also offered a few elementary courses by extension. By the fall of 1952, the University of California had dropped out of the program and the entire curriculum was under UNM.

An outstanding feature of the graduate center is the provision whereby an aspirant to the master's degree can fulfill all the requirements with residence entirely at Los Alamos. A campus residency period is required for the bachelor's or doctor's degree.

The Lab subsidizes the cost of one-half tuition for each of its student-employes in good academic standing who enroll in courses offered by the graduate center.

LASL officials believe this is a good investment. Dunn noted that 72 per cent of all staff members who participated in the Academic Training Program and received degrees are still employed by the Lab. This figure is equivalent to an annual termination rate of less than 3 per cent as compared to the overall termination rate of about 6 per cent for all LASL staff members.

core for UHTREX

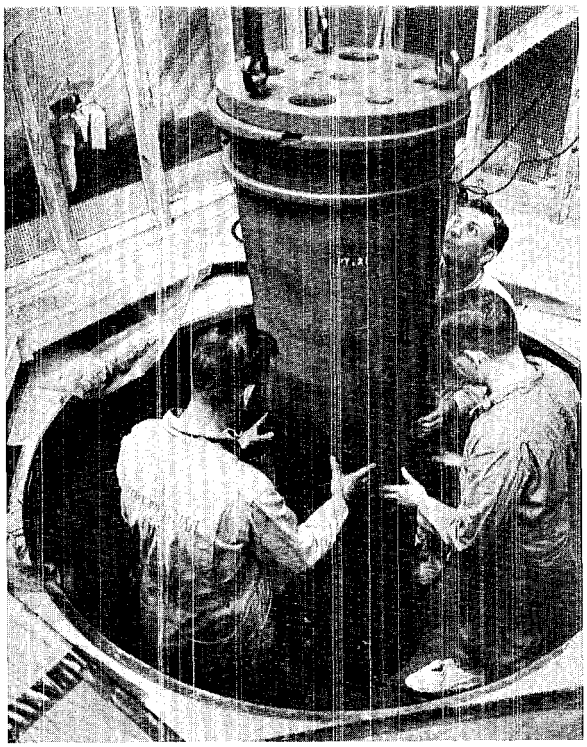
ultra high temperature reactor

Hurshel Ainsworth and Richard W. Johnson, both of K-4, carefully check UHTREX fuel element hole spacing.

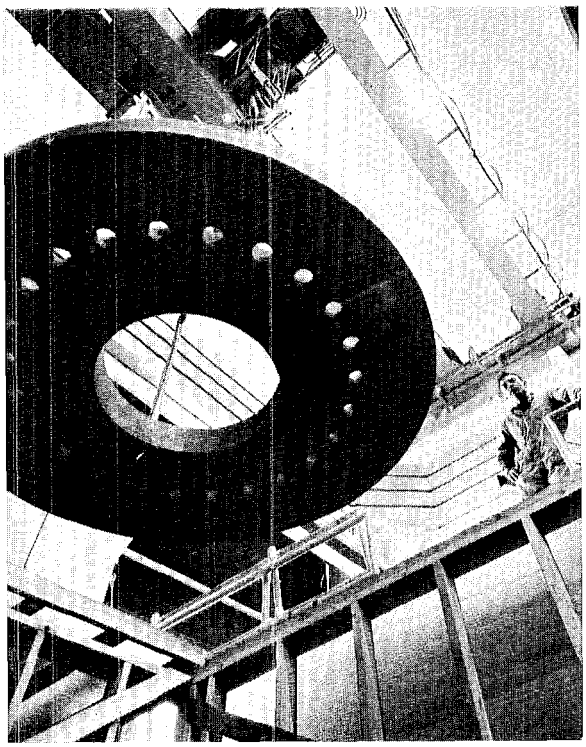
Culminating several years of design and construction effort by K Division, the graphite core for UHTREX has been assembled and expectations are that the 3 MW reactor will go critical late this year.

UHTREX (Ultra High Temperature Reactor Experiment) is a part of the AEC's program for developing high temperature gas-cooled reactors which use pressurized helium as coolant and graphite as the neutron moderator. It will be used to study uranium carbide fuels of advanced design. Components of UHTREX were generally designed by LASL and built by various commercial manufacturers.

Designed to operate at helium temperatures up to 2400° F, UHTREX will greatly extend the range of operating experience and explore the potential for higher efficiency (and lower cost) for nuclear power. Although reactors in the LASL Rover program operate much hotter than UHTREX, the latter's outlet gas temperature will greatly exceed that of contemporary power



Lloyd Wilkerson, center, supervises installation of core plug by Ainsworth, left, and Patrick Dolin, right.



Rotating top reflector is slowly lowered into position.

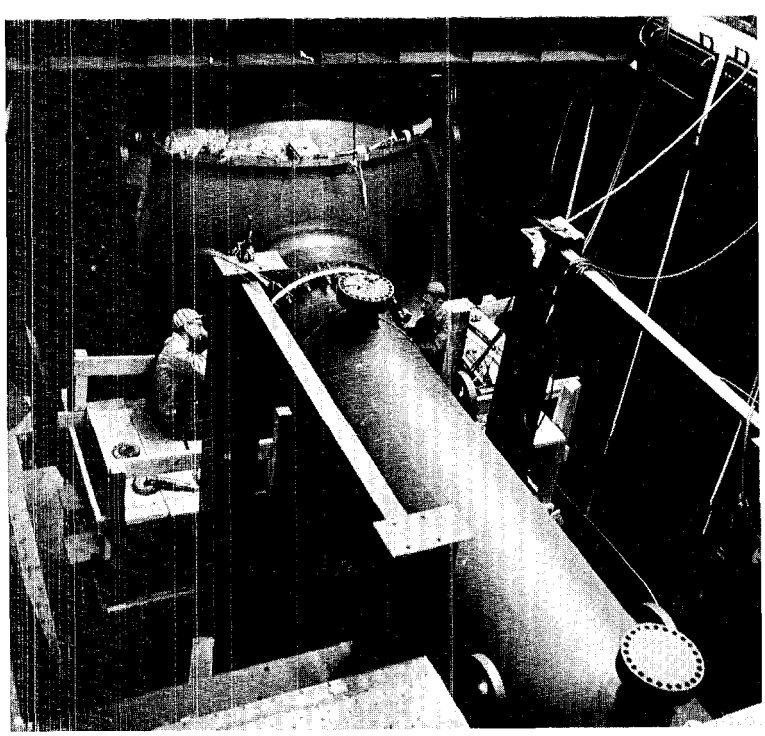
reactors that are designed for sustained operation with recirculating coolant.

For comparison, the early English gas-cooled reactors operate below 700° F and the newest of this type in the United States at Peach Bottom, Pa., operates at 1380°F.

The dramatic increase in reactor temperatures has resulted from the substitution of more refractory materials for the earlier metallic fuel cladding, used to prevent leakage of radioactive contamination into the cooling system. By using only graphite and metallic carbides for core materials in current high temperature reactors such as UHTREX, reactor technology has now outstripped the parallel development of heat exchangers and power conversion equipment that is needed to direct the nuclear heat to useful applications.

Greatest potential for UHTREX appears to be in conjunction with gas turbines that can use the higher temperatures effectively, according to John Russell, K-4 Group Leader.

UHTREX core is contained inside this massive 55-ton steel vessel. The top, not yet in place, weighs an additional 10 tons.



All Pinned For Service 95 For 20 Years at LASL

A group of 95, the largest to date, received pins and congratulations for 20 years of service to the University of California from LASL Director Norris E. Bradbury in a ceremony last month.

Also honored were 120 employes who had passed the 15-year mark and 73 who have served for 10 years. More than 4400 years of continuous service are represented by the 288 pins awarded.

THOSE AWARDED 20-YEAR PINS:

Norman T. Bensen, CMB-8; Ralph G. Black, SD-5; Charles D. Blackwell, H-1; Avery L. Bond, J-9; Melvin G. Bowman, CMB-3; Arthur C. Briesmeister, CMF-4; Franklin D. Burditt, SD-5; Charles R. Canfield, PER-DO; Donald E. Carlson, CMB-7.

Thomas E. Carman, CMB-7; Leo J. Carr, H-4; Glenn R. Champion, ADP-SF; Gordon C. Chappell, GMX-3; Michael L. Clancy, GMX-2; Horace F. Colyer, GMX-3; Richard L. Converse, GMX-3; Winston L. Dabney, AO-5; Leo C. Dallege, GMX-7; Neil Davis, W-1.

Manual B. Diaz, N-2; Robert S. Fitzhugh, J-8; Roy A. Frame, N-4; Ramon P. Fresquez, GMX-3; Lawrence P. Fulgenzi, GMX-3; James D. Gallagher, P-1; Edward C. Galvin, SD-1; Ernestine Garcia, H-1; Manuel Garcia, SD-1; William B. Gibson, CMB-11.

Jane H. Hall, Dir. Off.; James E. Harlow, CMF-9; Frank A. Hauser, GMX-3; Joe H. Herrera, CMB-AP; Jane Heydorn, P-2; Elmer L. Hilton, GMX-3; Robert O. Holm, P-14; Elmer J. Huber, CMF-2; Richard P. Jones, SD-1; John K. Lamb, P-1.

Ernest J. Lang, J-11; Harold J. Lang, P-9; Joseph A. Leary, CMB-11; Jose G. Lopez, H-1; Leslie E. McCartney, GMX-3; William A. McDonald, GMX-7; Wilbur D. McNeese, CMB-11; Edward N. MacMann, W-7; Jacobo Maestas, SP-8; E. Dean Manker, ADP-SF.

J. Carson Mark, T-DO; Alfredo L. Martinez, SD-O; Ramon J. Martinez, CMB-6; Antonia M. Mascarenas, D-2; John D. Mench, SD-6; Antonio J. Montoya, H-1; Arthur Murray, H-4; Bernice I. Nagy, Bus. Off.; Clifford E. Nilsson, SD-2; Clifford E. Nordeen, CMB-11.

Lester R. Norman, GMX-3; William I. Norwood, GMX-3; Charles A. Oliver, SD-5; Edward F. O'Mara, SP-3; James W. Osborn, GMX-4; George W. Peterson, SD-4; Dan Pfaff, ENG-2; Robert G. Pierce, GMX-3; George B. Ponton, Jr., SP-8.

Phil B. Porter, J-8; John G. Povelites, CMF-4; Roger L. Rasmussen, GMX-4; Charles A. Reynolds, ENG-4; Arno P. Roensch, SD-3; Albert R. Romero, SD-1; John H. Russell, K-4; Walter D. Sanborn, SP-12; Apolonio Sandoval, GMX-3; Jennie T. Scargall, GMX-7.

Donald H. Schell, CMB-6; Mortimer Schwartz, GMX-3; Neno Segura, SP-2; Haskell Sheinberg, CMB-6; Zygmund E. Sojka, SD-O; Francis E. Stack, SD-O; John W. Starner, P-2; Earl O. Swickard, K-3; Robert L. Thrap, GMX-3; Stanislaw Ulam, Dir. Off.

Isaac Valdez, CMF-9; Marvin L. VanBuskirk, SD-1; Robert M. VanLyssel, GMX-4; William J. West, SP-10; Roger J. Westcott, N-DO; Edward Wilder, GMX-3; and John G. Winston, P-1.

15-YEAR PIN AWARDS

Gordon H. Anderson, SD-6; John W. Atwood, SD-5; Lester M. Baggett, GMX-4; John L. Bailey, SD-5; Seth Baldwin, SP-2; Samuel J. Bame, P-4; Daniel E. Bannerman, W-3; Robert L. Barnes, GMX-3; Gene M. Barrington, SD-5; Ruth B. Beaty, Dir. Off.

Margaret M. Bensen, PER-3; Simon A. Bergauer, SD-5; Robert J. Berglund, SD-2; Keith Boyer, J-

DO; William D. Brasfield, GMX-3; Robert I. Brasier, ENG-DO; Theodore J. Brousseau, SD-5; Eugene Busse, SD-5; Santiago J. Bustamante, CMB-7.

Eloy J. Bustos, SP-2; William H. Chambers, W-7; Donald F. Clinton, SD-5; William H. Cooper, K-3; James R. Coulter, SD-5; Leroy D. Crawford, SD-5; Warren E. Crowe, K-4; Dorothy B. Dean, D-8; John K. Donohoe, CMB-6; Wade E. Dunwoody, K-4.

Claude Edwards, SD-5; Irwin S. George, SD-1; Willard F. Gettemy, SD-5; Martin W. Gilbert, SD-5; Walter B. Goad, Jr., T-4; Candelaria Gomez, CMB-1; Loyola E. Gomez, SP-4; Richard J. Gotti, AO-7; Glenn F. Grauerholz, GMX-3; Paul E. Harper, T-1.

Earl W. Henry, SD-1; Raymond C. Holmberg, SD-5; Frank M. Jackson, GMX-11; Karl W. R. Johnson, CMB-11; Reginald Jones, SD-5; Thomas I. Jones, CMB-6; Robert W. Kee, J-9; William E. Keller, CMF-9; Donald W. Kelley, CMB-8; Doris E. Kelley, CMB-AP.

Peter F. Kleczka, SD-1; Gordon W. Knobeloch, J-11; Thomas F. Land, AO-3; Don A. Lane, Jr., ENG-2; Robert J. Larson, SD-1; Roger B. Lazarus, T-7; Edward M. Little, P-15; Conrad L. Longmire, T-4; Virginia P. Lujan, D-2; William M. McCall, ENG-1.

Margaret L. McCartney, GMX-7; Paul L. McEwen, SD-2; John S. Malik, J-DO; James G. Marsh, SD-1; Aniseto Martinez, SP-3; Carlos A. Martinez, GMX-3; Celedonio O. Martinez, H-1; Delfino Martinez, GMX-3; Fermin Martinez, H-1; Mary G. Martinez, M&R.

Vicente Martinez, SP-3; John C. Matheson, ENG-4; Frank D. May, D-8; Delbert L. Meadows, GMX-6; Benjamin J. Melton, K-3; Robert M. Montoya, GMX-3; Benjamin L. Moore, W-DO; James W. Myers, GMX-3; Adele R. Mynaugh, CMB-11; Robert L. Nance, CMB-11.

Jim Olsen, SP-6; Blanche P. Pazdra, GMX-3; Robert T. Phelps, CMB-1; Marion L. Rector, SD-1; James H. Richardson, T-DO T; Leo J. Riedel, H-DO; Bruce N. Robbins, SD-5; Walter E. Roberts, SD-5; Jose F. Rodriguez, GMX-7; Leopoldo T. Romero, GMX-3.

Edward J. Rourke, AO-5; Colcson H. Ruminer, SD-5; Ernest W. Salmi, N-5; George A. Sawyer, P-15; Richard T. Schmitt, SD-5; Franklin D. Shadel, SD-1; Everett E. Shaw, J-7; Robert G. Shreffler, W-DO; Patricia C. Stein, CMF-2; Paul R. Stein, T-7.

Roy J. Stenholtz, SD-5; Leona Stewart, P-3; Paul F. Stibbard, W-1; Eugene L. Stivers, P-1; Lorene L. Sturgess, N-1; Delbert F. Sundberg, PER-DO; Sherman B. Sweet, AO-DO; Burton J. Thamer, K-2; Robert R. Timblin, SD-1; Lee L. Trujillo, SP-4.

James L. Tuck, P-DO; Malcolm Wallis, P-9; Glenn R. Waterbury, CMB-1; Harry G. Waugh, W-1; Wilfrid J. Weber, H-DO; Herbert L. Wheitsel, Sr., SD-5; Benjamin P. Williams, ENG-3; William W. Wood, GMX-10; William J. Wynne, SD-5; Al Zerwekh, CMB-1.

10 YEARS OF SERVICE

Gladys A. Alexander, P-DO; Charles T. Apel, CMB-1; Jack W. Barger, J-5; Elbert W. Bennett, J-10; Alfred G. Biggs, GMX-3; David J. Blevins, N-3; Walter R. Bramlett, M&R; Charles I. Browne, J-DO; Robert R. Brownlee, J-15; Patrick J. Campbell, GMX-3.

Fremont W. Carroll, ENG-2; Conard W. Christenson, H-7; Grace G. Cole, T-3; John W. Coleman, SD-5; Eva E. Colyer, GMX-3; Dale C. Croley, CMB-1; Clifford C. Cummings, N-3; Herman P. Deinken, W-3; Franklin P. Durham, N-DO; E. Philip Ehart, CMB-6.

Mildred K. Foglesong, N-DO; Willard W. Foreman, H-5; Gilbert L. Fuentes, CMB-AP; Margaret F. Gifford, GMX-3; Genevieve F. Grisham, J-11; Alvin F. Hasenbank, ENG-2; David A. Heimbach, M&R; Joseph M. Holt, Jr., W-4; Darryl D. Jackson, CMB-8.

Jack D. Jacobson, GMX-10; Carl Johnson, Jr., J-1; Jack E. Johnson, W-1; Edward A. Kmetko, CMF-5; William J. Lizut, GMX-3; Leo W. McDonough, N-2; Allan F. Malmberg, T-7; Allen R. Manthei, W-7; Calvin C. Maxwell, GMX-3; Ross Medina, K-DO.

Virginia M. Metz, H-1; Frank E. Montoya, H-8; Bruce H. Morrison, N-1; Charles J. Orth, J-11; Cayetano R. Ortiz, H-1; Gayle M. Patterson, H-1; Ralph H. Perkins, K-2; Clara B. Phillips, H-5; Robert G. Pitschke, N-3; Charles E. Pohlmann, ENG-2.

Theodore L. Prater, K-2; Clyde H. Reed, N-2; Thomas R. Regenie, N-3; Richard H. Reitmann, J-6; Richard L. Renfro, N-7; Margaret A. Riedel, T-1; Theodore T. Scolman, J-8; Shirley A. Scraper, AO-4; Sidney Singer, P-4; William E. Skivington, J-9.

William B. C. Smith, P-17; William Spack, Jr., T-7; Vernon J. Stephens, ENG-2; Emma O. Stevens, J-1; Jerry M. Tatom, J-6; Renato G. Tercovich, K-2; Linas L. Thorn, CMB-7; Almera L. Turner, D-2; Jose M. Ulibarri, D-8; Paul Wagner, CMF-13.

Paul P. Whalen, W-4; Emily M. Willbanks, T-6; Cornell Wohlberg, K-2.

Return To An Ancient City

BY JOHN V. YOUNG

Santa Clara Pueblo will celebrate its 10th annual Puyé Cliffs ceremonial with two days of dancing and festivities at the ancient city on the cliff top at the end of State Route 5 on July 30 and 31. A good-sized piece of the Los Alamos population is likely to be on hand.

Right now let it be said that if you pronounce Puyé as it is spelled, with the accent on the final *e* (pooh-yay) you are at least giving a reasonable approximation of the proper name, meaning "place of the cottontail rabbits." But if you slur it as most Anglos do, to make it come out póo-yee, with the accent on the *poo,* you are making a noise that in Tewa means a tanned deerskin. Maybe you don't care, but the Indians do, and it's their ancestral home.

The Santa Clarans, who are famous for their beautiful pottery, believe their progenitors lived on the

Rainbow dancers from Santa Clara create a kaleidoscopic effect.

The ancient chants and drum sounds again boom out from the Santa Clarans' ancestral home on the high mesa of Puyé.

cliffs of Puyé and beyond from some unknown time in the past right down to the arrival of the earliest Spanish explorers in the mid-16th century. They were still on the high mesas when Coronado came through in 1540, but by the time Oñate had established his first capitol at Yungue-yunque, across the Rio Grande from present-day San Juan, in 1598, they had moved to the valley at or near the present pueblo. Puyé Cliffs has just been designated as a National Historical Site by the National Park Service.

The Puyé Cliffs ceremonial is quite frankly an effort to attract tourists to the tribal park there, and to the magnificent recreation region of Santa Clara Canyon beyond it. The result is a considerable addition to the pueblo's income, for Santa Clara Canyon with its 20-odd miles of clear water, virgin forest and flower-dotted green mea-

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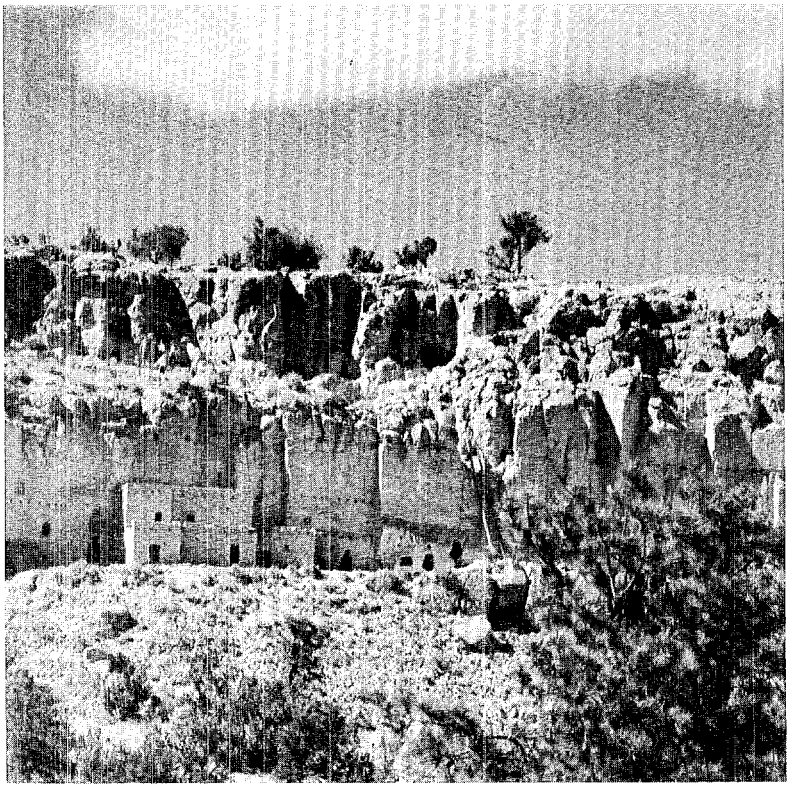
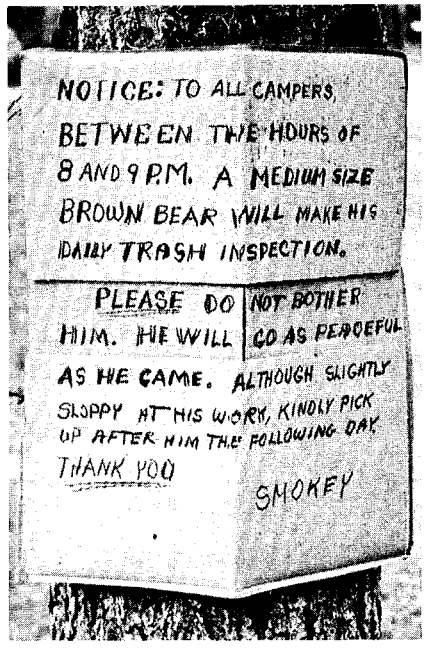


Reconstructed dwellings at Puyé Cliffs, recently named as National Historical Site.

meanwhile

BACK IN

Sparkling creek waters attract young visitors to Santa Clara Canyon.



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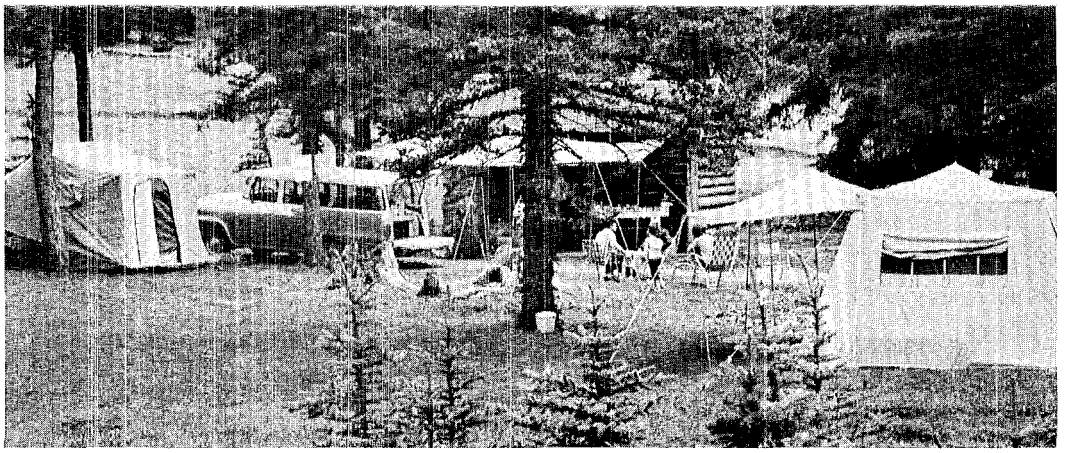
dows is rapidly becoming one of the most popular camping spots in the state. The Indians have set up some 25 camp-sites with shelters, fireplaces and toilets and several Adirondack shelters. They have also established and stocked five fishing ponds.

The Indians charge $1 for a day's fishing, $1 for a day's picnicking, $2 for the first night's camping and $1 a night thereafter, all of which is a great bargain. The fee keeps out the casual tourist and his beer cans, and the revenue goes to pay the Indian rangers who police the place and keep it as nearly spotless as the bears will permit. There are enough bears fond of raiding garbage cans and camps to be troublesome at times, even though the most obstreperous members of the tribe of Ursa are trapped and taken to less inhabited regions. Signs around the campgrounds and at the entrance warn people to leave the critters alone. They are not unfriendly, merely uninhibited.

There are two main routes to the canyon. Indian Forest Route 104, which is also State Route 5 as far as Puyé, intersects Indian Forest Route 105, which comes up from the pueblo, just below the Santa

THE CANYON



Life is easy and relaxed under the sheltering spruce trees at Los Alamos' favorite back door camping area.

Clara ranger station about 15 miles up the canyon. If you camp, fish or picnic below this point, a ranger will come around to collect the fee. In addition to the established campgrounds with their facilities, there are literally hundreds of other places a car or camper can pull off the road to stay an hour or a week.

Trout fishing is usually good in the stream as well as the lakes, although the water is usually so clear it is hard to approach the stream without being seen.

Getting back to Puyé Cliffs and the ceremonial, it is a fine opportunity to see a wide variety of Indian dances, because dancers from many other pueblos usually take part as well as the Santa Clarans. There are no restrictions on photography, other than common courtesy, once you have paid the entrance fee at the Puyé Park entrance. Indian handicrafts and food and refreshments are on sale on the cliff top both days.

Sudden thundershowers are common to the region in July—some protection from the sun and rain is advisable as you may be obliged to park as much as a quarter mile from the dancing plaza because of the crowds, and there is no natural shade or shelter on top. Some of the ruins have been partially restored, but they are merely standing walls with one or two closed storage sheds and a building used as a dressing room for the dancers.

The End

A large excavation on east side of T-1's Computer Building marks site of another addition.

LASL Continues Growth

From a cluster of log cabins to a sprawling complex of modern facilities—that's the history of the Los Alamos Scientific Laboratory.

And it continues to grow.

Construction currently under way or nearing completion at LASL amounts to almost $11.7 million, while that in the design or planning stage into fiscal 1968 brings that figure to $81 million.

The lion's share of the overall total is earmarked for the proposed Los Alamos Meson Physics Facility —some $55 million—which is now both in the design and planning stage.

The next largest project is the Fast Reactor Core Test Facility now nearing completion at Ten Site. Cost of the facility is $3.2 million, and installation of a reactor and related equipment will push the price to nearly $8 million.

Under study now by Project Sherwood physicists is a $7 million facility for Scyllac. If approved, construction of the Scyllac complex would begin in fiscal 1968.

Construction of the P Division Physics Analytical Center, budgeted at $830,000, has started and is due to be completed within a year. Nearing completion is a supplemental water supply for the technical areas costing $1.5 million. A new underground telephone cable system replacement and rehabilitation of a 13.2 kv electrical distribution system for GMX-3 is scheduled for completion in early 1967 at a cost of $218,000. The $490,000 office and laboratory addition at Ten Site is under construction.

Bids on a new Weapons Test Support Facility for J Division were opened last month with an apparent low bid received of $934,000.

N Division's $360,000 Pulsed Accelerator Building is scheduled for completion July 25, while the $410,000 addition to T-1's Computer Building—which includes installation of equipment—started last month.

Some of the major work in the design stage by LASL's Engineering Department includes a $488,000 Contaminated Waste Disposal Facility for H-7 and a J-11 Core Processing Facility to cost about $800,000.

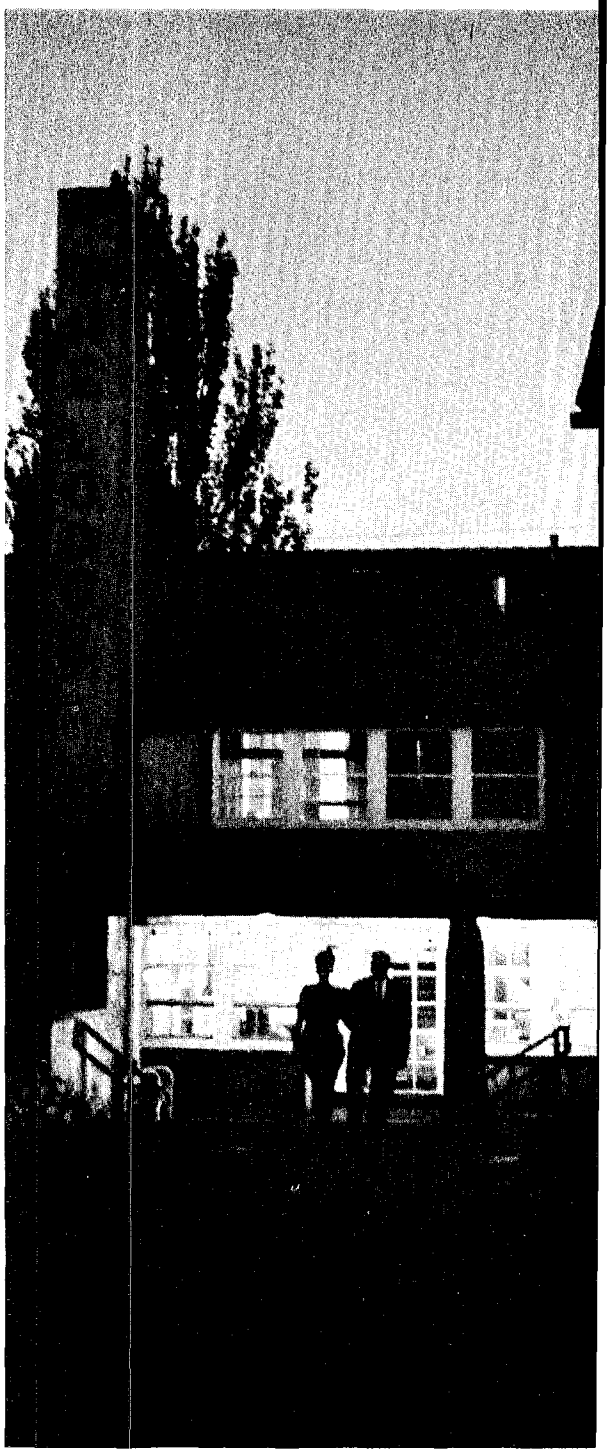
In the planning stage by the Engineering Department are: Terminal Facilities for a 115 kv power line costing $1.1 million; Reactor Systems Building to cost about $1.4 million; and $898,000 Equivalent Residual Dose Facility; and a maintenance contractor heavy equipment repair shop to cost $1.1 million.

Additional minor construction and modifications either under consrtuction, being designed, or planned account for the remainder of the $81 million total.

Farewell!

A Long Farewell The Lodge

By BARBARA STORMS



As the doors close behind the last of the guests this month, the lights will go out and The Lodge will end its 38 years as host on the Hill.

It will all be over this month. The last of the guests and the diners will cross the red-tiled threshold, somebody will lock the doors and The Lodge will end its 38 years as the center of a remarkable assortment of activity on the Pajarito Plateau.

For future Hill visitors, the dark confines of the old hotel will be replaced by the sparkling efficiency of the new Los Alamos Inn. There will be 84 spacious rooms, a cocktail lounge, restaurant, coffee shop, swimming pool and meeting rooms. It will be comfortable, convenient and attractive. But it just won't be the same.

No schoolboy ever carved his initials on its chairs nor received his diploma under its portal. No Town Council met there to discuss wartime shortages, the right to vote, or the mysterious ways of the Army. No Nobel scientist pondered a problem to speed development of the atomic bomb. Enrico Fermi never slept there, nor did Niels Bohr or Ernest Lawrence. Not even Klaus Fuchs. The end of The Lodge seems almost the biggest of many steps in the transformation of Los Alamos from a unique community to anybody's town.

Even from the start The Lodge was different. It was designed by Santa Fe Architect John Gaw Meem as the main dining hall for students and faculty of the Los Alamos Ranch School. Meem spent a year developing the design which he called an experiment in the architectural uses of materials indigenous to the region.

Special permission was obtained from the Department of Interior to cut some 800 Ponderosa pine trees in the Jemez mountains and each was especially selected by Meem and A. J. Connell, director of the school, according to the exact position it would occupy in the structure. After the logs had seasoned for a year, construction began in 1928.

The logs were arranged vertically and sealed with oakum, a hemp material used for centuries for caulking the seams of wooden ships. Locally cut aspen logs covered the seams. The massive stone fireplaces were built from Pajarito Plateau tufa.

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The Lodge

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In the original building, the dining room, a smaller meeting room, entry hall and kitchen occupied the lower floor. Nine upstairs rooms provided infirmary space, quarters for the school nurse and housemother, guest rooms for visiting parents and, at one time, living accommodations for A. J. Connell. A bell, still in its tower atop the building, summoned the 44-boy student body to meals.

The Lodge was named for Edward J. Fuller, a member of the school staff whose father, Philo Fuller, a Grand Rapids furniture manufacturer, bought a major interest in the school and helped finance it through a crucial period shortly after its founding. The Curtis Room, the smaller dining room, was named for Fayette S. Curtis, Jr., the school's first academic head master who is credited with putting the school on its sound academic footing.

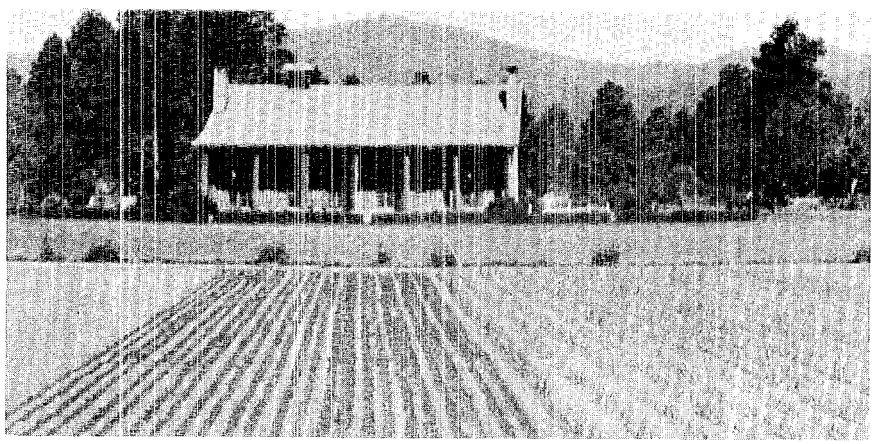
Peggy Pond Church, whose father, Ashley Pond, founded the school in 1917, remembers Fuller Lodge as "the place where the boys ate and were sick" but recalls many of the social activities as well.

The boys held dances there and presented Shakespearean plays and once there was a faculty wedding. Gilbert and Sullivan operettas were a regular feature and in the 1940-41 production of "Pinafore" a young student named John Crosby made his stage debut. Crosby was to return to the area many years later as founder and director of the Santa Fe Opera.

Impressive graduation ceremonies were held each spring on the long portal that looked eastward across cultivated fields where the Community Center now stands. Parents and visitors watched from the portal as immaculately uniformed students paraded by on horseback, followed by equally well-dressed boys armed with brooms and dustpans.

Then one evening in December 1942, students and faculty were called together and told that the school would be closed at the end of the semester at the request of the War Department. By February the school was gone and operation of The Lodge was taken over by the Army for "transient housing and messing of post and technical personnel."

Under the new management, headed by H. M. Acher, the big rustic building looked the same but the relaxed, carefree atmosphere was gone. There was a constant



The Lodge of Ranch School days looked east across rows of vegetables grown for the school on land now occupied by the Community Center.

Commencement ceremonies began with uniformed students parading by The Lodge portal on horseback. Children of school employes followed with brooms and dustpans.

stream of hurried, harried, important and top secret visitors and the guest register would have read like a Who's Who in Science. Lt. Gen. Leslie R. Groves, director of the Manhattan Project, was regularly assigned the famous "Throne Room" but the oft-told story that much of his business was conducted from the dais has been largely discounted.

In early 1943, about 4,000 meals were served monthly but the number grew rapidly to a maximum of 13,000. All civilians quartered at the Big House, the school's main building, ate at The Lodge and the first contingent of WACs was served there. Even hospital meals were prepared at The Lodge and carried across the street to patients in the barracks-like infirmary.

Before long food demands far exceeded the capacity of The Lodge and mess halls and cafeterias sprang up over the Mesa. But as the project spread out, The Lodge still remained the hub of activities.

A Town Council met at The Lodge to work out the unique problems of the half-civilian, half-military community and to serve as liaison between the two factions. Christmas and Easter concerts were held there; the Mesa Chorus gave its first performance of Handel's Messiah at The Lodge. And the old log walls rang constantly with the festive sound of parties.

The Lodge was available for group parties at $5 a night, and, according to Mrs. Robert Brode, a chronicler of early days, the theoretical physicists were among the first to use it. Their floor show, featuring Nick Metropolis, an amateur magician, set the standard for the future, Mrs. Brode reported.

Probably one of the most elegant affairs at The Lodge in the war years was given by members of the British Mission for their American hosts. Engraved invitations, instead of the usual mimeographed notices, inspired guests to bring out their most formal attire, marking the first time white ties, tails and long gloves ever appeared in Los Alamos.

The Lodge was the scene of another event that project historians have singled out as the turning point when post-war morale—and population—began its downward dive.

In December 1945, a selected group of Santa Fe residents were invited for their first look at Los Alamos at a party that was to begin with a reception at The Lodge followed by dinner at the homes of various scientists. But it was the year of the Water Shortage. Water had been in dangerously short supply since summer and the Army had issued strict conservation rules. Then on the eve of the party, a cold wave struck; a main froze; and there

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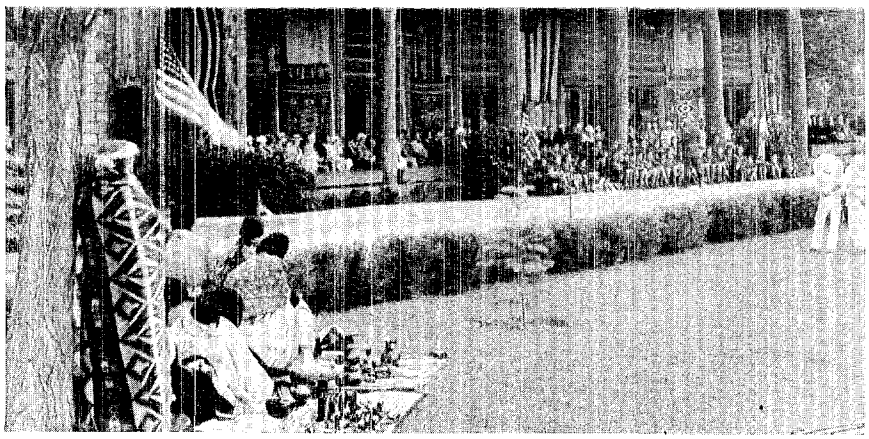
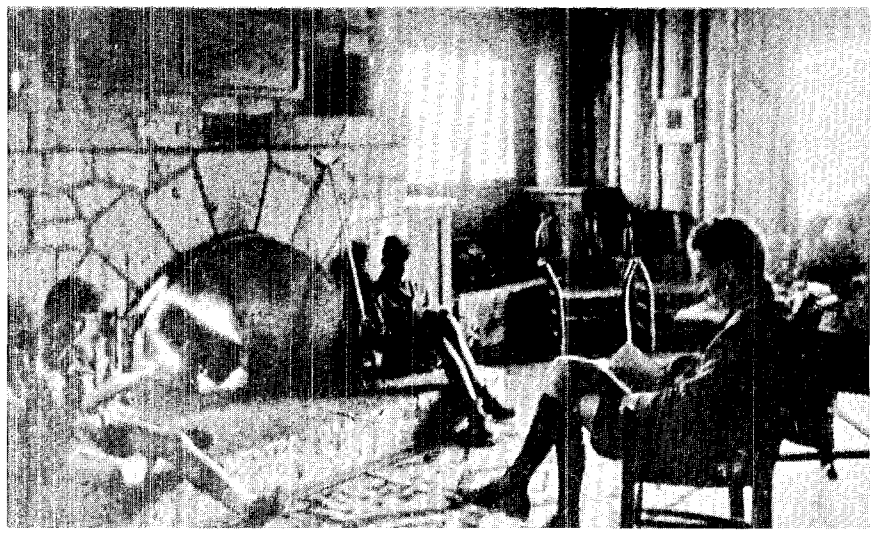


The east portal of The Lodge was the setting for the Ranch School's colorful graduation excercises which featured dances by Pueblo Indians.



Ranch School boys gathered in front of the huge stone fireplace in The Lodge's spacious entry hall to read and wait for dinner.

The Lodge

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was no water at all. At noon The Lodge announced it could not spare enough of the precious stuff to serve tea to the guests and the party was cancelled. But within a few hours water was trickling again (thanks, rumor had it, to battalions of soldiers dispatched to the frozen mains with boxes of matches) and the party was back on. Although historians say the event was a success, it prompted weary Los Alamos wives to think of the civilized conveniences to be had in the outside world. Before long the great exodus began.

With the departure of the Army in 1946, the Zia Company took over operation of The Lodge and undertook a major remodelling project that resulted in the present building. The dining room and kitchen were modified and two new wings, designed by W. C. Kruger & Associates, expanded the hotel capacity to about 75 guests. The enlarged Lodge opened early in 1949 with R. E. Carraway as manager.

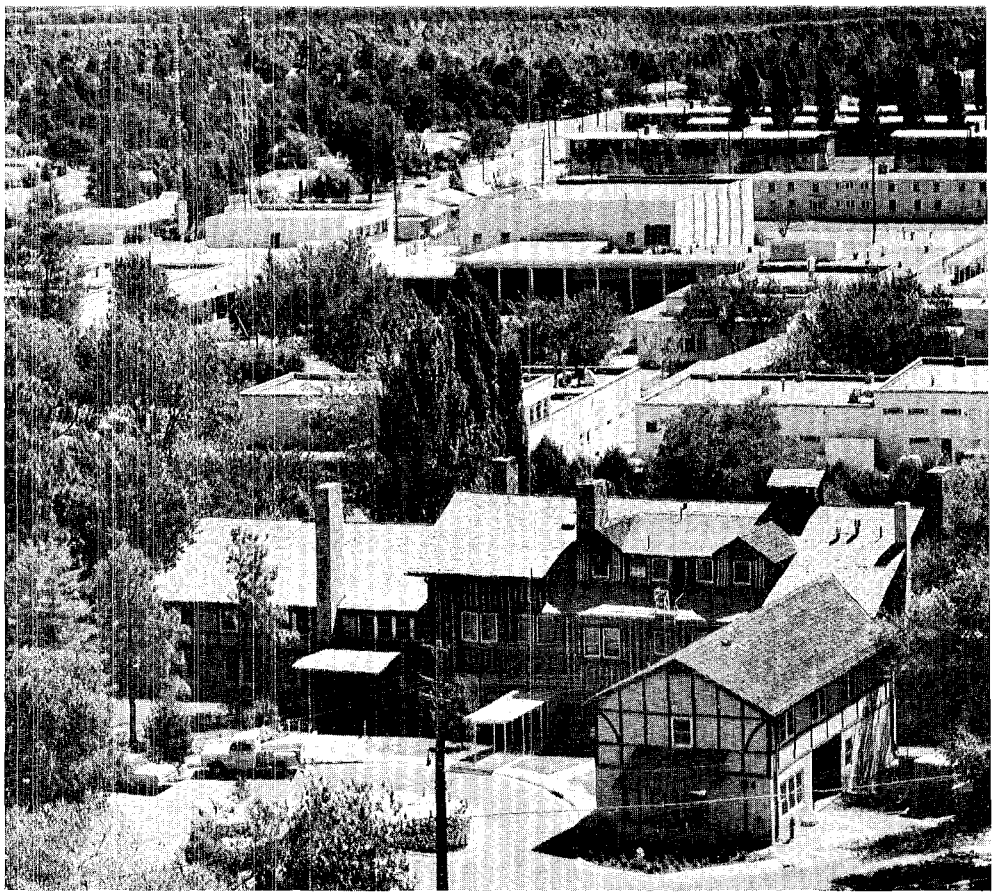
Zia continued to operate the motel for twenty years despite occasional efforts to entice a private operator to the Hill. Invitations to bid on the hotel were issued early in 1959, but the single response was so unreasonably low that the offer had to be withdrawn. No further effort was made to encourage private enterprise until the hotel site south of Trinity Drive was offered last year. The agreement between the AEC and the Los Alamos Inn calls for closing of The Lodge within ten days after the Inn opens.

Back in 1949 when new furniture replaced the original chairs and tables in the remodeled Lodge dining room, the Los Alamos Skyliner, a short-lived weekly, mourned:

"The old chairs with tree limbs for seats took a lot of abuse without cracking up . . . and some of the parties they went through were enough to shiver their timbers . . . The new furniture will be more comfortable but the old timers here will have nothing to remind them of the incidents they experienced when Los Alamos was a baby."

Now, 17 years later, the Lodge itself is being replaced, but the chances that old timers will have "something to remind them" are good. A "Save The Lodge" committee, an advisory group appointed by Area Manager Charles C. Campbell, has recommended that the building, which will be retained as AEC property, be transferred to the county and used as a museum and cultural center.

And so, perhaps, it is not the end after all, but the beginning of another chapter in the colorful life of Fuller Lodge.



As the modern post-war community spread out around it, The Lodge remained the hub, providing food, lodging and night life for ever increasing numbers.

The Lodge dining room has provided 38 years of good food and rustic atmosphere.

CDC 6600 JOINS LASL COMPUTERS

ACCEPTANCE TESTS UNDERWAY FOR FASTEST COMPUTING SYSTEM

LASL's outstanding computer facilities have been further enhanced by the arrival of a CDC 6600—the most powerful and fastest computer now available.

The 6600, which will be operated by Group T-1, joins the MANIAC II, two IBM 7094's, and the IBM 7030 (STRETCH) in the Laboratory's array of large computers.

Although it arrived in Los Alamos on June 20th, the computer was not expected to be available for computational purposes until some time after July 1st. Before it can be officially accepted by the Laboratory, it must pass a 30-day acceptance test.

As with all modern computers, the 6600, made by Control Data Corporation, is not a monolithic structure but instead consists of a number of modules or units. The central unit, the one that does the computing, is known as the Central Processing and Storage Unit. It is capable of storing 65,537 60-bit "words."

The numerical notation we use in everyday life is based on the number 10 and is known as decimal notation. It makes use of 10 distinct digits, from 0 through 9. Computers, however, are designed to use a different notation, based on only two digits, 0 and 1. This is called binary notation. Computers do all their calculations with these two binary digits, commonly known as bits. A 60-bit "word" is simply one that contains 60 zeros and ones.

Most large problems cannot utilize the computational units on a computer continuously. Rather, they are resolved in a series of steps, of which actual computation is only one. In between computing steps, a problem may require the execution of input or output operations in which the computer is seeking additional information or disposing of the results of calculations done thus far. Insofar as the computer is concerned, these operations -- though essential—are dead time because no arithmetic computation is being done.

To get around this problem of dead time, the 6600 is capable of handling a number of programs simultaneously. When one program goes from a calculational to an input or output phase, a second program can be calculating while the computer is performing input or output for the other program. If sufficient programs are in the computer, the net effect is to guarantee that the computer will be calculating more nearly continuously.

A computer can only operate as fast as it can enter and retrieve information from its storage or memory units. The CDC 6600 takes only a millionth of a second to store a given data word into or obtain it from the memory banks in its Central Processing and Storage Unit. Ten such activities can be in progress at any given time.

Other units making up the CDC 6600 are for the purpose of getting instructions and data into the Central Processing and Storage Units and results of computations out. One of these is a control console by which instructions can be given to the computer directly through a keyboard. The console also has two 10-inch cathode ray tubes, similar

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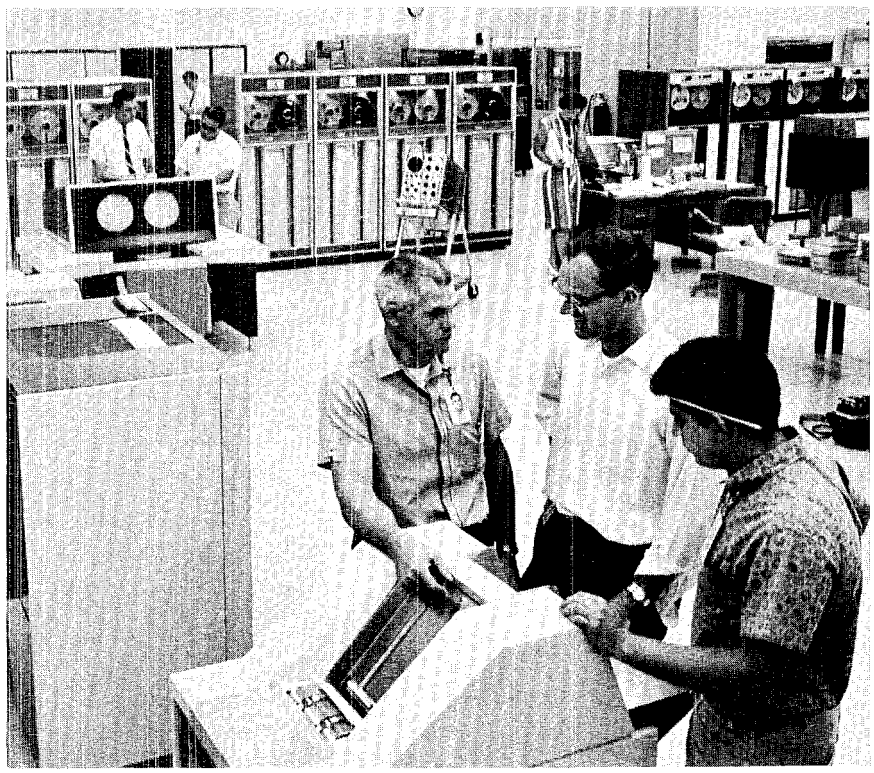
In foreground, Don Smith (left) and Abad Sandoval (right), both T-1, go over operation of card punch for new computer with Bill Stockwell of CDC.



CDC 6600

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to television screens, on which information related to computations in progress can be viewed directly.

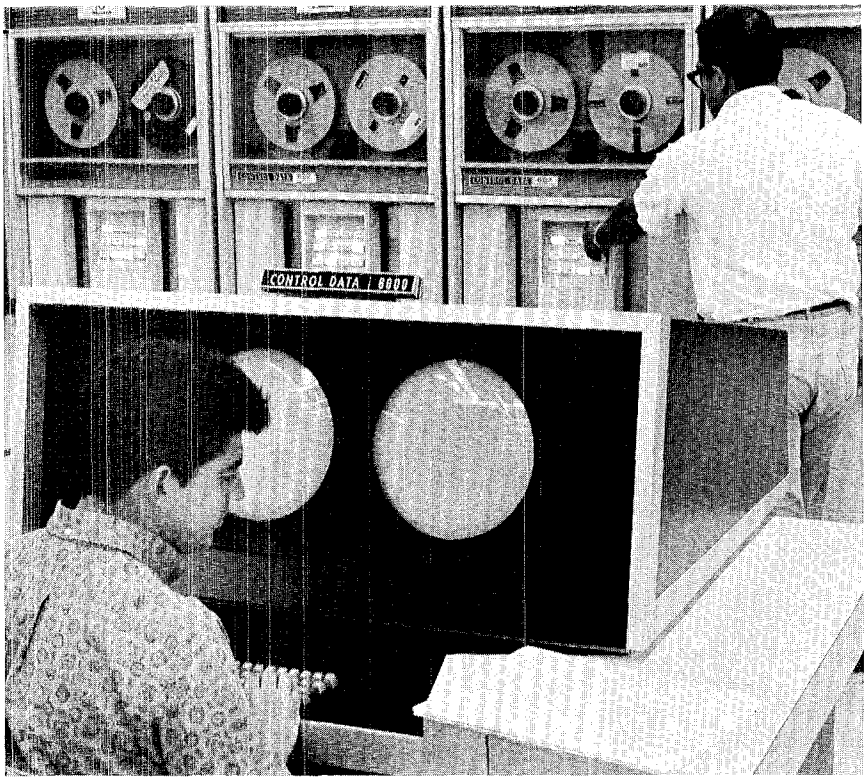
The most common way information is fed to computers is by means of punched cards. The 6600 has a punched card reader that can read 1200 cards per minute. Another unit is a card punch that does the reverse; it takes information from the computer and punches it on cards at a rate of 250 cards a minute.

Information from the computer can also be printed out on high-speed printers. There are two of these, each capable of printing 1,000 lines a minute, each line consisting of as many as 132 characters. Finally, there are eight magnetic tape units which can also be used to receive data from or enter it into the computer.

Normally, computational results from a computer are not transmitted directly onto punched cards or printouts, but rather are first stored on a large magnetic disk. One reason for this is that the computer operates faster than the input-output units and consequently would have to tie up more of its memory for storage of input-output data unless a large secondary storage system is available.

The 6600 was delivered to Los Alamos with two storage disks, each capable of storing in excess of 7.4 million 60-bit words. Each disk can transmit at an average rate of over 100,000 60-bit words per second to or from the computer. These disks are temporary, however, and are scheduled to be replaced by a single disk in February 1967. This disk will be capable of storing nearly 17 million 60-bit words in two modules, and will have a maximum transfer rate of 168,000 60-bit words per second for each module.

The size of problems that can be handled by this particular 6600 is somewhat limited by the memory capacity of the Central Processing and Storage Unit. To remedy this, an Extended Core Storage Unit, which will augment the memory of the computer, is scheduled for delivery to LASL in March 1967. This unit will have a storage capacity of 524,288 60-bit words. With it, larger complex problems can be handled more efficiently.



Sandoval inserts control instructions while John Ulibarri, T-1, changes data tape. Cathode ray tubes above keyboard display information about computations in progress.

With the delivery of the Extended Core Storage Unit, LASL's CDC 6600 computing system, as presently ordered, will be complete. Its overall cost will be about $4 million.

A question inevitably asked is: How does the 6600 compare with STRETCH? This depends on the type of problem being computed. If the program will fit in the main memory banks of the Central Processing and Storage Unit of the 6600, and if the problem is of a certain type known as a floating point problem, and if input-output considerations are ignored, then the computing speed of the 6600 is about five times faster than that of STRETCH. However, STRETCH has a main memory that is 50 per cent larger than that of the 6600. Consequently, it can handle in its main memory larger problems than the CDC computer.

The 6600 does have one new capability that is expected to eventually be quite useful to the Laboratory. Unlike the present computers, it has been designed to be operated with remote terminals. This means that the input and output units, i.e., consoles, card readers, printers, etc., can be located at some distance from the Central Processing and Storage Unit, rather than in the same area. Considerable developmental effort still remains to be done, however, before this capability becomes available.

The 6600, STRETCH, and the 7094's accept problems coded in similar dialects of the FORTRAN computer language. For many problems, this nearly common language should allow for the shifting of problems to the 6600 with a minimum of recoding. T-1 is now offering courses in FORTRAN programming for the 6600.

The Technical Side

Presentation, Physics Department, Wisconsin State University, Oshkosh, Wisc., April 26:

"Results of LASL Expedition at the May 30, 1965, Solar Eclipse" by D. H. Liebenberg, CMF-9.

Series of Lectures, California State Polytechnic College, San Luis Obispo, Calif., May 9-10 by Louis Rosen, MP-DO:

"Proposed New Accelerators—General Features and Purposes"

"Recent Experiments with Polarized Protons"

"Opportunities in Physics"

"Nuclear Science and Nuclear Scientists in the USSR"

Presentation, Oregon State University, Corvallis, Oregon, May 16:

"Meson Factories—The Next Step in Nuclear Physics" by Louis Rosen, MP-DO.

Presentation, Reed College, Portland, Oregon, May 17:

"Nuclear Science and Nuclear Scientists in the USSR" by Louis Rosen, MP-DO.

Seventh Semiannual Meeting of the Plutonium Weapons Information Exchange Group, Livermore, Calif., May 17-18:

"The Stability of Delta-Phase Plutonium-Gallium Alloys" by W. N. Miner, CMF-5.

"Dilute Gallium-Plutonium Alloys" by F. W. Schonfeld, CMF-5.

"Review of Current CMF-5 Research and Development Program in Plutonium Metallurgy" by F. W. Schonfeld, CMF-5.

Presentation, Knolls Atomic Power Laboratory, Schenectady, N. Y., May 17, and at Nuclear Engineering Seminar, Massachusetts Institute of Technology, Cambridge, Mass., May 19:

"Numerical Solution of the Transport Equation—the Need for Analysis" by Kaye D. Lathrop, T-1.

Colloquium Talk, Aerospace Corporation, San Bernardino, Calif., May 20:

"Photographic Observations of the Motion of an Artificially Produced Plasma in the Earth's Magnetic Field" by Herman Hoerlin, J-10.

Governor's Safety Conference, Albuquerque, N.M., May 27:

"Why Safety Glasses?" by J. R. Penland, H-3.

"Safety Training of Supervisors" by Roy Reider, H-3.

Presentation, Heat Pipe Conference, Sandia Corporation, Albuquerque, N.M., June 1-2:

"Heat Pipe Capability Experiments" by J. E. Kemme, N-5 (Invited paper).

"Status of the Engineering Theory of Heat Pipes" by Theodore P. Cotter, N-5 (Invited paper).

Presentation at Department of Physics, Oregon State University, Corvallis, Oregon, June 3:

"Determination of Small Nuclear-State Widths in the Continuum" by Peter Fessenden, P-12.

Second Annual Workshop on Computer-Oriented Statistical Techniques, Washington State University, Pullman, Wash., June 6-8:

"A Program for Analyzing the Unbalanced Nested Analysis of Variance Model" by Roger H. Moore, T-1.

IAEA Headquarters, Vienna, Austria, June 6-10: International Panel on "Uses of Lithium Drifted Germanium Gamma Ray Detectors for Research in Nuclear Physics":

"Neutron Capture Gamma Ray Spectroscopy—New Life for an Old Field" by Henry T. Motz, P-DO, Panel Member (Invited paper).

"Status Report on the Use of Lithium Drifted Germanium Detectors at the Los Alamos Scientific Laboratory" by Henry T. Motz, P-DO.

Tenth Annual Transformation Meeting, Lake Harmony, Pa., June 10-12:

"Simulation of the Development of Competence of Hemophilus Influenzae by a Cell-Free Factor(s) from Competent Cells" by B. J. Barnhart, H-4.

Cryogenic Engineering Conference, Boulder, Colorado, June 13-15:

"Disturbance of Capacitive Liquid Level Gauges by Nuclear Radiation" by W. L. Willis, CMF-9.

"Pressure Oscillations Induced by Forced Convection Heating of Dense Hydrogen" by R. S. Thurston, N-4, J. D. Rogers, CMF-9, and V. J. Skoglund, UNM.

Seminar, "Mechanical Properties Testing Techniques" David T. Eash, CMF-13, Leader of Seminar.

Chairman, Session on Liquid Hydrogen Safety and Moderator of Liquid Hydrogen Safety Panel, Roy Reider, H-3.

"Project Rover Liquid Hydrogen Safety" by T. E. Ehrenkranz, H-3.

"Hydrogen Applications to Rocket Propulsion" by F. J. Edeskuty, CMF-9.

The Technical Side

continued from preceding page

"Cryogenic Seals and Gaskets" by J. C. Bronson, CMF-9, Chairman of Seminar on Seals and Gaskets. (Invited paper)

Seminar, "Cooldown of Large LH_2 Storage Dewars" by R. C. Comer, Marshall SFC, D. H. Liebenberg and F. J. Edeskuty, both CMF-9, Chairmen.

Fifth National Meeting for Society of Applied Spectroscopy, Chicago, Ill., June 13-17:

"The Significance of Force Constants; A Comparison of Metal-Hexacyanide Complexes and Metal Carbonyls" by L. H. Jones, CMF-4. (Invited paper)

"Reduction of Interferences in Gamma-n Activations" by D. M. Holm and W. M. Sanders, both K-1.

"An Analytical Method for Unfolding Complex Spectra" by W. M. Sanders, K-1.

"He^3 Activation of Carbon and Oxygen Followed by Autoradiography" by D. M. Holm, W. M. Sanders, both K-1, and J. A. Basmajian, K-2.

AIAA Second Propulsion Joint Specialists Conference, Air Force Academy, Colorado Springs, Colo., June 13-17:

"Cooled High Temperature Thermocouples for Phoebus Reactors" by B. G. Goodier, N-4.

"Nuclear Reactor Control with Stepping Motor Actuators" by B. G. Strait and R. M. Lang, both N-4.

"On the Effects of Reactor Operating Time on Cooldown Requirements and Mission Applications" by C. A. Fenstermacher, J-18, and D. T. Oakley, USPHS.

"Design and Analysis of an Emergency Cooldown System for Nuclear Rocket Reactor Ground Tests" by C. A. Fenstermacher, G. Breisch, and M. J. Nutter, all J-18.

"Design, Analysis and Performance of an Experimental Liquid-Hydrogen-Water Heat Exchanger" by J. R. Bartlit, K. D. Williamson, both CMF-9, J. B. Henshall, J. Rink, both J-17, and M. J. Nutter, J-18.

"Stability of Gas Flow Distribution Among Parallel Heated Channels" by C. A. Bankston, W. L. Sibbitt, both N-7, and V. J. Skoglund, UNM.

"T-Map, An Analysis of the Thermal History to be Expected in the Phoebus I Reactor Under Loss of Coolant Conditions" by G. R. Armstrong, J-DO, NRDS.

"Critical Assembly Mockup Studies of the Phoebus II Rover Reactor" by S. J. Balestrini, C. C. Byers, A. M. Gage, and J. D. Orndoff, all N-2.

"Review of Transfer Function Measurements in the Nuclear Rocket Program Using Noise Techniques" by A. Wasserman, C. Bodenschatz, G. Steiner, L. James, all Westinghouse, J. D. Balcomb, J. A. Johnson, and T. E. Springer, all N-4.

"Evaluation of Advanced Phoebus-NERVA Fuel Elements Under Simulated Reactor Conditions" by L. L. Lyon, I. D. Leffler, R. W. Leep, all N-1, and M. B. Blinn, Westinghouse.

"Propulsion Reactor Temperature Control with the Internal Power Loop Eliminated" by E. A. Brown and J. D. Balcomb, both N-4.

The following are CLASSIFIED PAPERS:

"Hydrogen Corrosion of Graphite Materials and Graphite Reactor Components" by J. W. H. Chi, Westinghouse, and C. E. Landahl, N-1.

"Development Status of Graphite Reactors" by F. P. Durham, N-DO.

"The Afterheater Concept Applied to the Phoebus II-Size Reactor" by H. J. Newman, N-3, J. L. Sapir, N-2, R. G. Gido, N-7, and D. G. Rose, N-1.

"Phoebus II Reactor Design" by V. L. Zeigner, N-3, and W. L. Kirk, N-DO.

"A Critical Study of the Behavior of Phoebus-1A Reactor Fuel Elements" by R. L. Petty, N-1.

International Institute of Refrigeration—Commission I Meeting, Boulder, Colo., June 16-18:

"Use of He II Persistent Current as Gyro Element in Inertial Navigation" by Paul Sikora, T-9, E. F. Hammel, Jr., and W. E. Keller, both CMF-9.

"Cryogenic Problems in Nuclear Physics Experiments with Crystals Containing Polarized Nuclei" by T. R. Roberts, CMF-9.

"Thermal Contact Equations and Methods" by S. G. Sydoriak, CMF-9.

"Self-Switching Flux Pump" by H. L. Laquer, K. J. Carroll, and E. F. Hammel, Jr., all CMF-9.

"Heat Transfer Between Liquid Helium and Strip Wound Magnet Coils" by S. G. Sydoriak, T. R. Roberts, and H. L. Laquer, all CMF-9.

"Microdegree Temperature Controller for Liquid He II Bath" by George O. Bjarke, P-1.

American Physical Society Meeting, Minneapolis, Minn., June 20-22:

"Some Observations on the Flow of a Tenuous Plasma in a Uniform Magnetic Field" by Derrick Atkinson, Culham Laboratory, England, and J. A. Phillips, P-14.

"Magnetic Properties of $DyAl_2$ and $NdAl_2$" by N. G. Nereson, G. P. Arnold, both P-2, and C. E. Olsen, CMF-13.

"Ballooning of Beta-I Plasmas with Sharp Boundaries" by R. L. Morse, P-18. (Invited paper)

Twelfth Annual National Meeting, American Nuclear Society, Denver, Colo., June 20-23:

"Removal of ^{137}Cs from Molten Sodium by Means of Getters" by J. C. McGuire, K-2.

"Fabrication and Properties of Copper-Boron Carbide Control Material for Phobeus II Reactor" by H. Sheinberg and Robert W. Keil, both CMB-6.

"Fast Transients in Liquid Plutonium" by Byron M. Carmichael, K-1.

"Irradiation Performance of Liquid Plutonium-Cobalt-Cerium Alloys" by J. A. Basmajian and L. D. Kirkbride, both K-2.

"The Irradiation of Liquid Plutonium Fast Reactor Fuels in a Thermal Reactor" by G. L. Ragan and R. L. Cubitt, both K-1.

"Recent Developments in High Temperature Plutonium Compounds" by J. A. Leary, CMB-11. (Invited paper)

"A Comparison of Three Methods of Oxygen Concentration Measurement in Sodium" by C. C. McPheeters and J. M. Williams, both K-2.

"Thermodynamic Properties of Plutonium Mononitride from Electromotive Force Measurements" by G. M. Campbell and J. A. Leary, both CMB-11.

"The Solubilities of Refractory Elements in Liquid Plutonium" by D. F. Bowersox and J. A. Leary, both CMB-11.

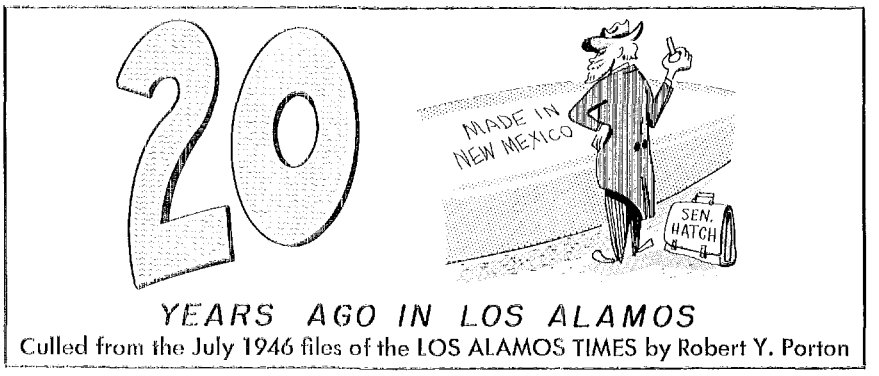
"Fast-Reactor Irradiation Effects on Type 316L and 17-4 PH Steels" by W. R. Martin, J. R. Weir, Jr., both ORNL, J. A. Basmajian and L. D. Kirkbride, both K-2.

"Special Problems Associated with the Determination of Large Negative Reactivity Changes in Fast Neutron Systems" by G. E. Hansen, N-2.

"Mass Transfer of Ta in Molten Pu-Co-Ce Fuels—The Linear Mass Transfer Experiment" by J. C. Biery and C. R. Cushing, both K-2.

"On the Accuracy of the S_2 Equations in Two-Dimensional Geometry" by K. D. Lathrop, T-1.

"The Use of Secondary Storage in Nuclear Codes" by W. J. Worlton, T-1.



YEARS AGO IN LOS ALAMOS

Culled from the July 1946 files of the LOS ALAMOS TIMES by Robert Y. Porton

And That Means Los Alamos

Senator Carl Hatch, N.M., a member of President Truman's evaluation committee on the Bikini bomb tests, made sure that the underwater bomb detonated yesterday was properly marked, and that his state came in for her share of honors. After several names were suggested for the bomb, Senator Hatch chalked "Made in New Mexico" on the side of the caisson.

Metals Society Grants Charter To Hill Group

The first chapter of any national organization to be set up on The Hill came into being this week when the American Society for Metals granted a charter to Los Alamos. The first slate of officers included Frank Kubosch, James M. Taub and Gerold Tenney.

Anniversary of Trinity Explosion

Tuesday, July 16, will mean "Trinity" on The Hill. A year ago, the men of Los Alamos gathered at Trinity site near Socorro, N.M., for the first man-made atomic explosion. Much of the story of Trinity was at Los Alamos itself, where for months there had been building up a tension so acute it was like an atmospheric pressure. But the memories of Trinity are best remembered by the scientists of Los Alamos—many of whom are still with the project—thoughts of the spectacle of that explosion which ushered in the Age of Atomic Energy.

Educators Here Today

Twenty-three representatives of 17 western colleges and universities are attending a conference here to discuss a method of training future scientists at the Los Alamos Scientific Laboratory. The conference marks the first time the laboratory has invited a large group of persons, not connected with the Manhattan Engineer District, to visit the facilities. The educators are here on invitation from Dr. Norris E. Bradbury, director, in which he outlined the proposed cooperative plan between the schools and this laboratory. According to Dr. Bradbury, the purpose of the proposed program will be to make it possible for graduate students and faculty members to come here and "carry out research on basic problems in nuclear physics and chemistry important to this project."

Officer Discharged

Second Lt. Richard L. Kennedy, post signal officer, left this week for discharge at Fort Sam Houston, Texas. The lieutenant expects to be back in Los Alamos next week as chief of the signal section.

Editor's Note: On June 19, 1966, Richard L. Kennedy became Group Leader of ENG-5, LASL.

new hires

Albert E. Albrechtsen, Las Vegas, Nevada, J-5 NRDS.

John O. Barner, San Diego, Calif., K-2.

Merrill D. Keehn, Klamath Falls, Oregon, CMB-14.

John W. McMullen, Pomona, Calif., ENG-1.

Sally J. Donahoe, Los Alamos, PER-3 (Rehire).

Andrew E. Norris, Upton, N.Y., J-11 (Rehire).

Delfido Serrano, Espanola, N.M., SP-4.

Jose Benjamin Lujan, Santa Fe, N.M. P-DO (Casual).

Frank A. Rickey, Jr., Tallahassee, Fla., P-DOR.

Hooper E. Wheeler, Rocklin, Calif., ENG-1.

Yates E. Murray, Los Alamos, GMX-4 (Casual).

Diana Louise Ellis, Los Alamos, CMB-3.

Tonie V. Cordova, Fairview, N.M., GMX-1.

Kenneth W. Hanks, Dallas, Texas, P-16 (Rehire).

Sandra L. Gill, Los Alamos, SP-12 (Casual).

David C. Wesley, Texarkana, Texas, SD-1.

Brower R. Burchill, Cleveland, Ohio, H-4.

William R. Carter, Jr., Redlands, Calif., CMB-7 (Rehire).

Paul W. Allison, Boulder, Colorado, MP-4.

William B. Hutchinson, Las Cruces, N.M., CMB-1 (Rehire).

William L. Richmond, Jr., Santa Fe, N.M., PUB.

Bert P. Trujillo, Chimayo, N.M., M&R.

Daniel N. Payton, III, Rolla, Mo., T-9 (Short Term).

Phyllis O. Dube, Los Alamos, GMX-1.

William J. Shlaer, Cambridge, Mass., MP-3 (Rehire).

William P. Goodwill, Stillwater, Okla., GMX-4.

Howard D. Sutphin, Las Cruces, N.M., P-1.

Donald R. Walborn, Albuquerque, N.M., ENG-1.

Eugene G. Loyd, Willow Springs, Mo., P-2.

Bill F. Bentley, New Orleans, La., P-9.

John H. Kottmann, Denver, Colorado, K-4.

Carol E. Price, Los Alamos, D-3.

Michael D. Morris, Stillwater, Okla., H-1.

What's Doing

All times listed are Mountain Daylight time

DON JUAN PLAYHOUSE: Outdoor theater between Los Alamos and Santa Fe, near San Ildefonso Pueblo. Tickets at box office, Decol's in Los Alamos, and Interior Accents in Santa Fe. Curtain 9:15 MDT.

Friday, Saturday, July 15 and 16—"Antigone," by Jean Anouilh.

Friday, Saturday, July 22 and 23— Two one-act plays: "A Resounding Tinkle," by N. F. Simpson; "The Dumb Waiter," by Harold Pinter.

OUTDOOR ASSOCIATION: No charge, open to the public. Contact leader for information regarding specific hikes.

Thursday, July 14, night hike—Ken Ewing, leader.

Sunday, July 17, Lake Peak—Penitente Cirque—return to Winsor Trail. 12 miles, 2500 feet—Ken Ewing, leader.

Tuesday, July 19, night hike—Dibbon Haggar, leader.

Saturday, July 23, Pine Springs via Pine Springs Trail—Bob Skaggs, leader.

Thursday, July 28, night hike—Bob Skaggs, leader.

Saturday, July 30, Heart Lake and return. One day, 10 miles, 2000 feet—Betty Hansbury, leader.

Saturday, July 30-31, Latir Lakes from Cabresto and return—Mike Williams, leader.

Thursday, August 4, night hike—Betty Hansbury, leader.

Saturday, August 6, Guaje Ridge Trail from Camp May—Betty Perkins, leader.

Tuesday, August 9, night hike—Virginia Winsor, leader.

YOUTH OPERA LECTURES: Open to the public, no charge. Sponsored by Los Alamos Opera Guild and Los Alamos Schools Music Department. High School Little Theater.

Sunday, July 24—"Rake's Progress," lecture by Junior Opera Guild members, 7:00 p.m.

Tuesday, August 2—"Rigoletto," lecture by Mrs. Donald Hagerman, 7:00 p.m.

SANTA FE OPERA: Tickets available at Los Alamos Building & Loan, Monday, Wednesday and Friday, 10. a.m. to 1 p.m. Curtain time 9:30 p.m. MDT.

Wednesday, July 13—"Don Giovanni."

Friday, July 15—"Dialogues of the Carmelites."

Saturday, July 16—"Tosca."

Wednesday, July 20—"Dialogues of the Carmelites."

Friday, July 22—"Don Giovanni."

Saturday, July 23—"Dialogues of the Carmelites."

Wednesday, July 27—"The Rake's Progress."

Friday, July 29—"The Rake's Progress."

Saturday, July 30—"Don Giovanni."

Wednesday, August 3—"Capriccio."

Friday, August 5—"Capriccio."

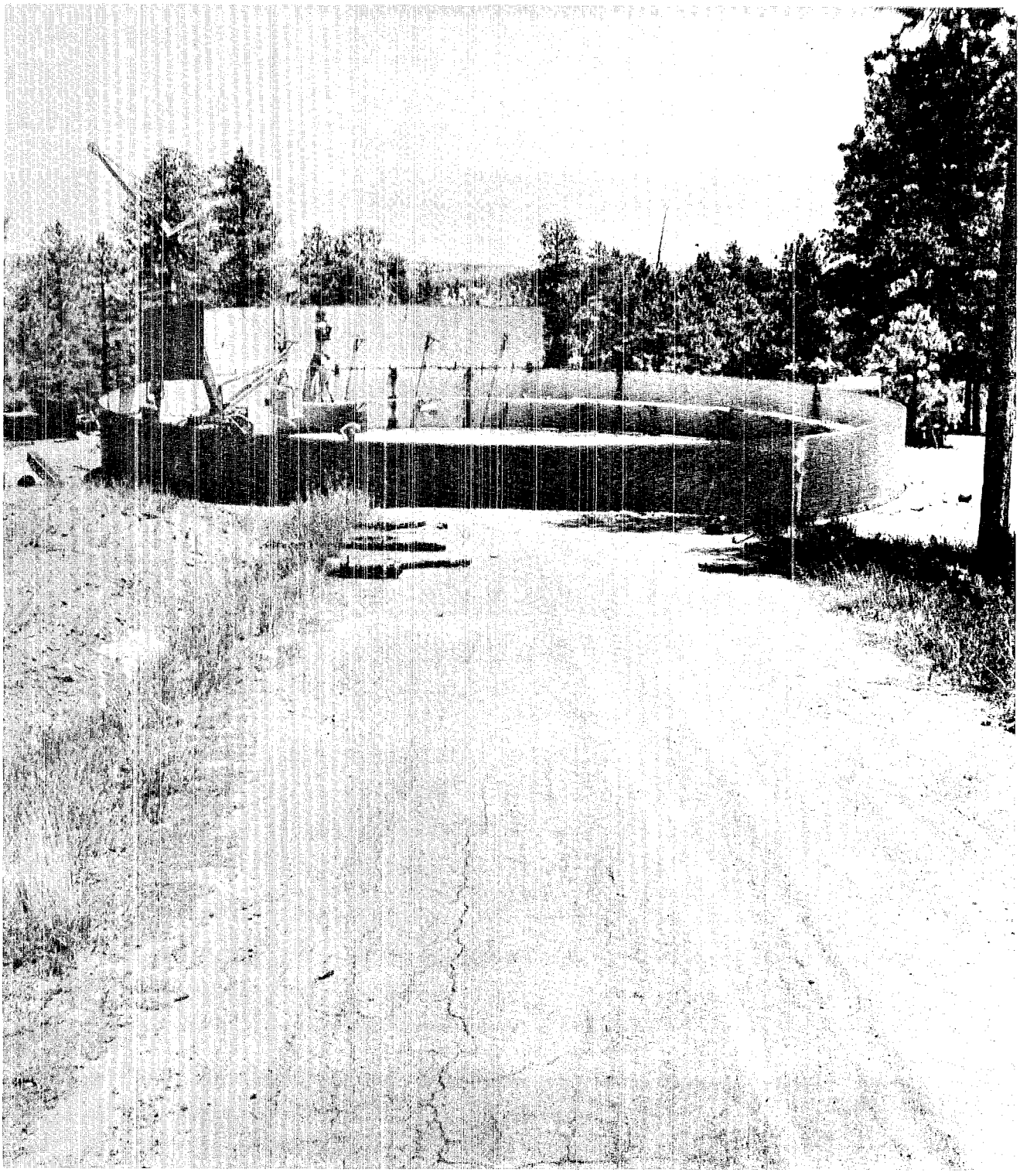
Saturday, August 6—"Rigoletto."

Wednesday, August 10—"Rigoletto."

Friday, August 12—"Rigoletto."

Saturday, August 13—"Tosca."

VACATION READING FOR FUN CLUB: Mesa Public Library. All school age children invited to join and enjoy new books, story times and films. Last day, August 5, club members will see Disney film, "The African Lion," at the Civic Auditorium.



If you have been using the abandoned portion of the old West Road as a shortcut to the ski area, forget it. There is a 1.5 million gallon water tank in the middle of it. The new tank is at the head of a supply and storage line designed to feed either the Laboratory or the town area. The water will be pumped up from the new well field in Pajarito Canyon, where a very welcome addition to the community's supply recently was brought in.

Henry T. Motz
3187 Woodland
Los Alamos, New Mexico
87544